

Response to PSD Incompleteness Notification, Items 1 and 10

The response to this item is divided into two portions. First, BWTX briefly responds to the specific questions about the emissions calculation methodology presented in the application. Second, BWTX presents a proposed, revised emission calculation methodology.

Methodological Remarks

The data in the referenced publication was selected because BWTX felt that it was methodologically apt: it was the only study identified providing comprehensive, directly measured data on the composition of vapors in the headspace of a crude oil storage tank. As EPA observes, however, several assumptions had to be made in order to use the data to develop emission factors. These assumptions were guided by two customary heuristics in developing emission calculations: first, assumptions should be scientifically-based, and should be conservative to the extent that their accuracy is not known; and second, they should be susceptible to verification in the form of permit monitoring requirements.

The mean was selected for several parameters for which multiple results were reported because these parameters were treated as random variables. A sample mean corresponds to the expected value of a random variable.

The solubility of gases in liquids is usually pressure-dependent, and not well-modeled by Raoult's law.¹ When the pressure of a system is suddenly reduced (e.g., when crude oils are removed from reservoirs), "weathering" or flash volatilization of gaseous compounds such as methane, ethane, carbon dioxide and nitrogen is expected. This intuition is consistent with the speciation data discussed below. Excluding these low-molecular weight compounds from the vapor phase molecular weight estimation was a conservative assumption which tended to increase reported emissions.

Basic assay data were compiled from fourteen crude oil samples representing the range of crude oils BWTX expects to handle. Reported dissolved H₂S values range from 0–2 ppm, consistent with assumed value of 2 ppm used in the application.

Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14
H ₂ S (ppm)	1	1	2	2	2	2	1	1	1	0	—	1	2	1

BWTX understands stabilized lease condensate to be a type of crude oil, when factors such as geologic reservoir and volatility are controlled for, and is unaware of any methodology for identifying a particular sample of unknown provenance as "crude oil" rather than "condensate." This understanding is reflected in the terms of the suggested NOMA. To answer EPA's specific question, BWTX does not currently plan to load condensate at the SPM terminal.

¹J. H. Hildebrand. "Solubility." J. Am. Chem. Soc. 1916, 38(8) 1452–1473.

Revised Methodology for Determining Speciated Emission Rates

In order to address EPA's request to "calculate emissions based on known values for the crude oil you intend to export for all pollutants," BWTX obtained detailed sampling data for five crude oil samples which are representative of the range of crude oils that BWTX expects to handle.

Data available for each sample included a boiling point distribution (ASTM D7169), a detailed hydrocarbon analysis (ASTM D7169 Appendix 1), relative densities of different cuts (various methods), and an analysis of the LPG cut (initial boiling point – 70° F; ASTM D2163). The data provided detailed information on the liquid phase composition of a crude oil sample.

In order to estimate the composition of the vapors in equilibrium with each liquid sample, BWTX computed mole fractions for each constituent. Next, published K-factor nomographs² were used to determine equilibrium gas phase mole fractions of methane and ethane, and Raoult's law was used to determine gas phase partial pressures for all other constituents. Raoult's law was not used for methane and ethane because their respective critical temperatures may be exceeded at ambient conditions.

In order to determine the molecular weight of the crude oil sample as a whole, the molecular weight of each cut for which relative densities were reported was determined using the following published correlation,³ where T_b is the middle boiling point of a petroleum fraction in Kelvins and d is the relative density of the cut.

$$MW = \frac{0.010770T_b^{1.52869+0.06486\ln\left(\frac{T_b}{1078-T_b}\right)}}{d} \quad (1)$$

The proportion of the total sample corresponding to a particular cut, as well as the middle boiling point of each cut, was determined from boiling curves. For the LPG cut, the molecular weight was calculated directly from the speciation data mentioned above rather than from Goossens' correlation. The liquid phase average molecular weight is the harmonic mean of the molecular weights of the various cuts, weighted by their mass fractions.

Once mole fractions were calculated for each constituent reported in the detailed hydrocarbon analysis (the number of positively identified constituents ranged from 82–91), partial pressures were calculated for each constituent (excepting methane and ethane) using Raoult's law at two temperatures: 72.1° F (annual average) and 95° F (assumed worst-case hourly average). Pure component vapor pressures were calculated from Antoine equation coefficients downloaded from NIST Webbook. Where published coefficients were not identifiable, a structurally similar isomer was selected as a surrogate for purposes of determining vapor pressures.

Constituent-specific partial pressures and calculated yi values for methane and ethane were used to develop a complete speciation of the vapor phase in equilibrium with the liquid phase of the sample, and thence to calculate the vapor phase molecular weight. Once the average vapor phase molecular weight was estimated, it was possible to determine the vapor phase mass fraction of each constituent. Additionally,

²Gas Processors Suppliers Association. 2004. Engineering Data Book (Sec. 25). Tulsa, OK.

³Goossens, Adriaan G. Prediction of Molecular Weight of Petroleum Fractions. Ind. Eng. Chem. Res. 1996, 35: 985–988.

partial pressures were summed to obtain a total vapor pressure and a total VOC vapor pressure for each sample and temperature (ten values total). Vapor phase molecular weights (lb/lbmol), VOC vapor pressures (psia), and emission rates (based on product throughputs and pumping rates represented in the application) are reported below for each sample and temperature condition.

Sample	1	2	3	4	5
MW (72.1° F)	59.37	57.07	56.89	53.04	55.94
MW (95° F)	60.32	58.09	57.75	53.57	56.79
HC VP (72.1° F)	5.24	3.37	4.59	6.44	4.55
HC VP (95° F)	7.74	4.94	6.74	9.32	6.67
VOC VP (72.1° F)	5.24	3.31	4.38	5.86	4.28
VOC VP (95° F)	7.74	4.83	6.36	8.28	6.18
HC ER (lb/hr)	7488	4607	6247	8007	6071
HC ER (tpy)	11767	7276	9859	12904	9611
VOC ER (lb/hr)	7488	4504	5892	7118	5632
VOC ER (tpy)	11767	7144	9407	11749	9051

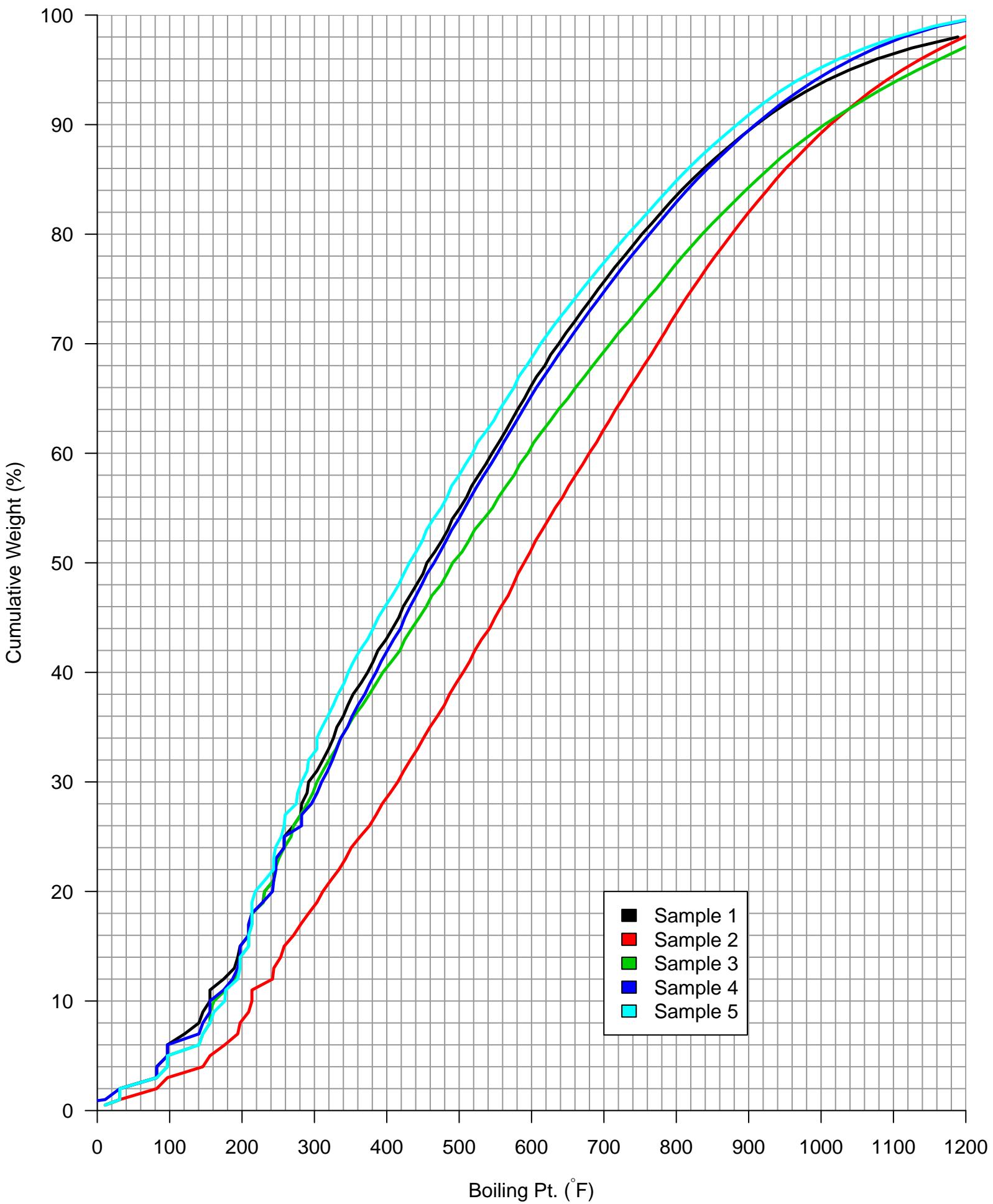
Vapor phase mass fractions for HAP constituents are summarized below for each sample at the T=95° F condition. Styrene was detected in only one sample. Isooctane, cresols, and naphthalene were not positively identified in any sample.

Sample	1	2	3	4	5
n-Hexane	3.20 %	3.09 %	3.57 %	3.13 %	3.57 %
Benzene	0.34 %	0.058 %	0.35 %	0.20 %	0.34 %
Toluene	0.19 %	0.13 %	0.28 %	0.13 %	0.33 %
m-Xylene	0.097 %	0.046 %	0.048 %	0.037 %	0.074 %
p-Xylene	0.049 %	0.056 %	0.034 %	0.028 %	0.043 %
o-Xylene	0.022 %	0.021 %	0.018 %	0.014 %	0.022 %
Ethylbenzene	0.011 %	0.017 %	0.027 %	0.011 %	0.021 %
Styrene	0.001 %	—	—	—	—

More detailed results, supporting calculations and figures are included as in Appendix A of this submission. While the results of this analysis generally support the assumptions originally made in the permit application, BWTX believes that EPA's preference is to use site-specific data to estimate emission rates, and requests that the source's potential to emit be updated based on the revised emission rates presented herein.

Appendix A-1— Boiling Curves for Five Crude Oil Samples

Boiling Curve



Appendix A-2— Sample Calculation for Liquid Phase Molecular Weight Estimation

$$\text{MW} = g(T_b, d) = \frac{0.010770 T_b^{1.52869 + 0.06486 \ln\left(\frac{T_b}{1078 - T_b}\right)}}{d} \quad (2)$$

$$T/K = f(T/{}^{\circ}\text{F}) = \frac{T/{}^{\circ}\text{F} + 459.67}{1.8} \quad (3)$$

$$\text{MW} = g \circ (f \circ T_b, d) \quad (4)$$

Where:

T_b = Middle poiling point of fraction (K) (from boiling curve)

d = Relative density of fraction (dimensionless)

Cuts for which density data are available (°F):

IBP	- 70
70	- 155
155	- 185
185	- 210
210	- 270
270	- 335
335	- 380
380	- 450
450	- 510
510	- 580
580	- 660
660	- 785
785	- 900
900	- 1050
1050	- FBP

For Sample 1,

$$T_b/{}^{\circ}F = \begin{bmatrix} - \\ 105.1 \\ 161.6 \\ 197.1 \\ 243.8 \\ 299.8 \\ 354.9 \\ 415.9 \\ 479.9 \\ 544.8 \\ 618.2 \\ 718.4 \\ 837.1 \\ 962.6 \\ 1166.2 \end{bmatrix} \quad d = \begin{bmatrix} - \\ 0.6494 \\ 0.6974 \\ 0.7172 \\ 0.7402 \\ 0.7614 \\ 0.7676 \\ 0.7780 \\ 0.7956 \\ 0.8095 \\ 0.8227 \\ 0.8418 \\ 0.8516 \\ 0.8649 \\ 0.8820 \end{bmatrix} \quad \text{MW/LPG} = \frac{\text{MW}}{\text{lb/lbmol}} = \begin{bmatrix} 58.9 \\ 78.0 \\ 88.0 \\ 95.9 \\ 107.2 \\ 122.6 \\ 141.6 \\ 163.9 \\ 188.3 \\ 216.5 \\ 252.8 \\ 309.9 \\ 298.3 \\ 518.4 \\ 832.1 \end{bmatrix} \quad (5)$$

MW_{LPG} is determined directly from the LPG analysis.

$$\text{MW}_{avg} = \left(\frac{\sum_{i=1}^n w_i \text{MW}_i^{-1}}{\sum_{i=1}^n w_i} \right)^{-1} \quad (6)$$

$$w/\%(\text{from boiling curve}) = \begin{bmatrix} 2.76 \\ 7.17 \\ 2.77 \\ 4.49 \\ 8.72 \\ 9.54 \\ 5.39 \\ 8.16 \\ 6.96 \\ 7.94 \\ 8.16 \\ 10.34 \\ 7.05 \\ 5.82 \\ 4.72 \end{bmatrix} \quad (7)$$

$$\text{MW} = 156.7 \text{ lb/lbmol} \quad (8)$$

Appendix A-3— Speciation Calculations

Sample 1, T=72.1° F

Average Molecular Weight		
Liquid Phase:	156.75	lb/lbmol
Vapor Phase:	59.37	lb/lbmol
Methane / Ethane		
Methane K:	167.10	
Methane Mass% Liq	0.00000000	%
Methane y_i	0.00	ppm
Methane Mass% Vap	0.00000000	%
Ethane K:	28.63	
Ethane p_i :	0.00	psia

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
n-butane	1.90000	0.05124	32.33790	1.65696	0.31595	30.93028
propane	0.32000	0.01137	128.84470	1.46558	0.27946	20.75558
i-butane	0.60000	0.01618	46.68395	0.75538	0.14404	14.10059
i-pentane	1.85000	0.04019	12.06945	0.48509	0.09250	11.24029
n-pentane	2.17000	0.04714	8.94467	0.42168	0.08041	9.77108
n-hexane	2.15000	0.03911	2.59458	0.10146	0.01935	2.80818
2-methylpentane	1.36000	0.02474	3.65310	0.09037	0.01723	2.50103
3-methylpentane	0.86000	0.01564	3.27061	0.05116	0.00976	1.41594
n-heptane	2.04000	0.03191	0.77018	0.02458	0.00469	0.79093
cyclopentane	0.25000	0.00559	5.50431	0.03075	0.00586	0.69273
2-methylhexane	0.94000	0.01470	1.11769	0.01643	0.00313	0.52889
methylcyclohexane	1.30000	0.02075	0.78425	0.01628	0.00310	0.51323
3-methylhexane	0.90000	0.01408	1.04376	0.01469	0.00280	0.47289
methylcyclopentane	0.38000	0.00708	2.35878	0.01669	0.00318	0.45122
cyclohexane	0.52000	0.00968	1.66588	0.01613	0.00308	0.43608
2,2-dimethylbutane	0.10000	0.00182	5.54852	0.01009	0.00192	0.27932
toluene	1.11000	0.01888	0.47674	0.00900	0.00172	0.26639
n-octane	1.76000	0.02415	0.23106	0.00558	0.00106	0.20472
benzene	0.20000	0.00401	1.61828	0.00649	0.00124	0.16293
2-methylheptane	0.84000	0.01153	0.34326	0.00396	0.00075	0.14515
3-methylheptane	0.73000	0.01002	0.34326	0.00344	0.00066	0.12614
2,4-dimethylpentane	0.14000	0.00219	1.68004	0.00368	0.00070	0.11840
2,2-dimethylpropane	0.01000	0.00022	22.76363	0.00495	0.00094	0.11459
2,3-dimethylpentane	0.18000	0.00282	1.17057	0.00330	0.00063	0.10607
1t,3-dimethylcyclopentane	0.14000	0.00223	1.28929	0.00288	0.00055	0.09086
1t,2-dimethylcyclopentane	0.13000	0.00208	1.28929	0.00268	0.00051	0.08437
2,2-dimethylpentane	0.09000	0.00141	1.79972	0.00253	0.00048	0.08154
1,3-dimethylbenzene	1.03000	0.01521	0.13786	0.00210	0.00040	0.07148
2,2,3-trimethylpentane	0.16000	0.00220	0.83572	0.00183	0.00035	0.06731

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
1c,3-dimethylcyclopentane	0.08000	0.00128	1.28929	0.00165	0.00031	0.05192
2,2,3-trimethylhexane	0.53000	0.00648	0.18914	0.00123	0.00023	0.05046
4-methylheptane	0.29000	0.00398	0.34223	0.00136	0.00026	0.04996
1c,2t,3-trimethylcyclopentane	0.35000	0.00489	0.26991	0.00132	0.00025	0.04756
n-nonane	1.60000	0.01955	0.05669	0.00111	0.00021	0.04566
1,1-dimethylcyclopentane	0.07000	0.00112	1.28929	0.00144	0.00027	0.04543
2,4-dimethylhexane	0.17000	0.00233	0.50803	0.00119	0.00023	0.04348
1,4-dimethylbenzene	0.49000	0.00723	0.14614	0.00106	0.00020	0.03605
3,3-dimethylpentane	0.05000	0.00078	1.41421	0.00111	0.00021	0.03560
1t,4-dimethylcyclohexane	0.16000	0.00223	0.26991	0.00060	0.00012	0.02174
2,3-dimethylhexane	0.09000	0.00123	0.39143	0.00048	0.00009	0.01773
1,2-dimethylbenzene	0.29000	0.00428	0.10833	0.00046	0.00009	0.01581
1c,2c,3-trimethylcyclopentane	0.11000	0.00154	0.26991	0.00041	0.00008	0.01495
i-propylcyclopentane	0.11000	0.00154	0.26991	0.00041	0.00008	0.01495
1c,2-dimethylcyclohexane	0.12000	0.00168	0.24055	0.00040	0.00008	0.01453
3,3-dimethylhexane	0.06000	0.00082	0.47758	0.00039	0.00007	0.01443
2,2-dimethylhexane	0.05000	0.00069	0.57233	0.00039	0.00007	0.01441
3-methyloctane	0.48000	0.00587	0.05669	0.00033	0.00006	0.01370
2-methyloctane	0.47000	0.00574	0.05669	0.00033	0.00006	0.01341
4-methyloctane	0.35000	0.00428	0.05669	0.00024	0.00005	0.00999
1,1-dimethylcyclohexane	0.07000	0.00098	0.26991	0.00026	0.00005	0.00951
2,5-dimethylheptane	0.32000	0.00391	0.05669	0.00022	0.00004	0.00913
2,2,3-trimethylbutane	0.01000	0.00016	1.75367	0.00027	0.00005	0.00883
ethylbenzene	0.10000	0.00148	0.15620	0.00023	0.00004	0.00786
2-methyl-3-ethylpentane	0.03000	0.00041	0.50948	0.00021	0.00004	0.00769
2,5-dimethylhexane	0.03000	0.00041	0.50948	0.00021	0.00004	0.00769
1c,2t,4-trimethylcyclopentane	0.05000	0.00070	0.26991	0.00019	0.00004	0.00679
3,4-dimethylhexane	0.03000	0.00041	0.36235	0.00015	0.00003	0.00547
1t,2c,3-trimethylcyclopentane	0.04000	0.00056	0.26991	0.00015	0.00003	0.00543
3-methyl-3-ethylpentane	0.02000	0.00027	0.38632	0.00011	0.00002	0.00389
2,3,5-trimethylhexane	0.03000	0.00037	0.18914	0.00007	0.00001	0.00286
4,4-dimethylheptane	0.10000	0.00122	0.05669	0.00007	0.00001	0.00285
2,2,5-trimethylhexane	0.02000	0.00024	0.27648	0.00007	0.00001	0.00278
3,3-diethylpentane	0.07000	0.00086	0.05669	0.00005	0.00001	0.00200
3,3-dimethylheptane	0.07000	0.00086	0.05669	0.00005	0.00001	0.00200
2,3,4-trimethylhexane	0.02000	0.00024	0.18914	0.00005	0.00001	0.00190
c-octene-2	0.01000	0.00014	0.28862	0.00004	0.00001	0.00145
1,1-methylethylcyclopentane	0.01000	0.00014	0.26991	0.00004	0.00001	0.00136
1c,3-dimethylcyclohexane	0.01000	0.00014	0.26991	0.00004	0.00001	0.00136
2t-ethylmethylcyclopentane	0.01000	0.00014	0.26991	0.00004	0.00001	0.00136
3c-ethylmethylcyclopentane	0.01000	0.00014	0.26991	0.00004	0.00001	0.00136
3t-ethylmethylcyclopentane	0.01000	0.00014	0.26991	0.00004	0.00001	0.00136
1c,2t,4t-trimethylcyclohexane	0.03000	0.00037	0.07721	0.00003	0.00001	0.00117
3,5-dimethylheptane	0.04000	0.00049	0.05669	0.00003	0.00001	0.00114

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
3,4-dimethylheptane	0.03000	0.00037	0.05669	0.00002	0.000004	0.00086
Styrene	0.01000	0.00015	0.10747	0.00002	0.000003	0.00054
1,1,2-trimethylcyclohexane	0.01000	0.00012	0.07721	0.00001	0.000002	0.00039
1c,2t,4c-trimethylcyclohexane	0.01000	0.00012	0.07721	0.00001	0.000002	0.00039
2,2-dimethylheptane	0.01000	0.00012	0.05669	0.00001	0.000001	0.00029
4-ethylheptane	0.01000	0.00012	0.05669	0.00001	0.000001	0.00029

Sample 1, T=95°F

Average Molecular Weight		
Liquid Phase:	156.75	lb/lbmol
Vapor Phase:	60.32	lb/lbmol
Methane / Ethane		
Methane K:	190.00	
Methane Mass% Liq	0.00000000	%
Methane y_i	0.00	ppm
Methane Mass% Vap	0.00000000	%
Ethane K:	35.50	
Ethane p_i :	0.00	psia

Component	m _{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m _{vap} (%)
n-butane	1.90000	0.05124	47.45453	2.43152	0.31417	30.27285
propane	0.32000	0.01137	176.65380	2.00940	0.25963	18.97994
i-butane	0.60000	0.01618	67.05331	1.08497	0.14018	13.50808
i-pentane	1.85000	0.04019	18.67352	0.75051	0.09697	11.59899
n-pentane	2.17000	0.04714	14.16178	0.66763	0.08626	10.31810
n-hexane	2.15000	0.03911	4.43665	0.17350	0.02242	3.20270
2-methylpentane	1.36000	0.02474	6.08944	0.15063	0.01946	2.78060
3-methylpentane	0.86000	0.01564	5.48122	0.08574	0.01108	1.58270
n-heptane	2.04000	0.03191	1.42681	0.04553	0.00588	0.97728
cyclopentane	0.25000	0.00559	8.96348	0.05008	0.00647	0.75238
2-methylhexane	0.94000	0.01470	2.01204	0.02959	0.00382	0.63502
methylcyclohexane	1.30000	0.02075	1.42286	0.02953	0.00382	0.62105
3-methylhexane	0.90000	0.01408	1.88579	0.02655	0.00343	0.56985
methylcyclopentane	0.38000	0.00708	4.03151	0.02853	0.00369	0.51437
cyclohexane	0.52000	0.00968	2.90982	0.02818	0.00364	0.50803
toluene	1.11000	0.01888	0.90368	0.01706	0.00220	0.33679
2,2-dimethylbutane	0.10000	0.00182	8.93253	0.01625	0.00210	0.29991
n-octane	1.76000	0.02415	0.46549	0.01124	0.00145	0.27507
benzene	0.20000	0.00401	2.86487	0.01150	0.00149	0.19238
2-methylheptane	0.84000	0.01153	0.66923	0.00771	0.00100	0.18875
3-methylheptane	0.73000	0.01002	0.66923	0.00670	0.00087	0.16403
2,4-dimethylpentane	0.14000	0.00219	2.93417	0.00643	0.00083	0.13792
2,3-dimethylpentane	0.18000	0.00282	2.08700	0.00588	0.00076	0.12613
2,2-dimethylpropane	0.01000	0.00022	33.79926	0.00734	0.00095	0.11348
1t,3-dimethylcyclopentane	0.14000	0.00223	2.27727	0.00509	0.00066	0.10704
1t,2-dimethylcyclopentane	0.13000	0.00208	2.27727	0.00473	0.00061	0.09940
1,3-dimethylbenzene	1.03000	0.01521	0.28049	0.00427	0.00055	0.09700
2,2-dimethylpentane	0.09000	0.00141	3.11782	0.00439	0.00057	0.09421
2,2,3-trimethylpentane	0.16000	0.00220	1.51201	0.00332	0.00043	0.08123
2,2,3-trimethylhexane	0.53000	0.00648	0.37895	0.00245	0.00032	0.06743
4-methylheptane	0.29000	0.00398	0.66709	0.00265	0.00034	0.06495

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
n-nonane	1.60000	0.01955	0.11691	0.00229	0.00030	0.06281
1c,2t,3-trimethylcyclopentane	0.35000	0.00489	0.52453	0.00256	0.00033	0.06164
1c,3-dimethylcyclopentane	0.08000	0.00128	2.27727	0.00291	0.00038	0.06117
2,4-dimethylhexane	0.17000	0.00233	0.96101	0.00224	0.00029	0.05485
1,1-dimethylcyclopentane	0.07000	0.00112	2.27727	0.00254	0.00033	0.05352
1,4-dimethylbenzene	0.49000	0.00723	0.29779	0.00215	0.00028	0.04899
3,3-dimethylpentane	0.05000	0.00078	2.47165	0.00193	0.00025	0.04149
1t,4-dimethylcyclohexane	0.16000	0.00223	0.52453	0.00117	0.00015	0.02818
2,3-dimethylhexane	0.09000	0.00123	0.75123	0.00093	0.00012	0.02270
1,2-dimethylbenzene	0.29000	0.00428	0.22572	0.00097	0.00012	0.02198
1c,2c,3-trimethylcyclopentane	0.11000	0.00154	0.52453	0.00081	0.00010	0.01937
i-propylcyclopentane	0.11000	0.00154	0.52453	0.00081	0.00010	0.01937
1c,2-dimethylcyclohexane	0.12000	0.00168	0.47036	0.00079	0.00010	0.01895
3-methyloctane	0.48000	0.00587	0.11691	0.00069	0.00009	0.01884
2-methyloctane	0.47000	0.00574	0.11691	0.00067	0.00009	0.01845
3,3-dimethylhexane	0.06000	0.00082	0.90338	0.00074	0.00010	0.01820
2,2-dimethylhexane	0.05000	0.00069	1.06869	0.00073	0.00009	0.01794
4-methyloctane	0.35000	0.00428	0.11691	0.00050	0.00006	0.01374
2,5-dimethylheptane	0.32000	0.00391	0.11691	0.00046	0.00006	0.01256
1,1-dimethylcyclohexane	0.07000	0.00098	0.52453	0.00051	0.00007	0.01233
ethylbenzene	0.10000	0.00148	0.31926	0.00047	0.00006	0.01072
2,2,3-trimethylbutane	0.01000	0.00016	3.01654	0.00047	0.00006	0.01013
2-methyl-3-ethylpentane	0.03000	0.00041	0.96528	0.00040	0.00005	0.00972
2,5-dimethylhexane	0.03000	0.00041	0.96528	0.00040	0.00005	0.00972
1c,2t,4-trimethylcyclopentane	0.05000	0.00070	0.52453	0.00037	0.00005	0.00881
1t,2c,3-trimethylcyclopentane	0.04000	0.00056	0.52453	0.00029	0.00004	0.00704
3,4-dimethylhexane	0.03000	0.00041	0.69690	0.00029	0.00004	0.00702
3-methyl-3-ethylpentane	0.02000	0.00027	0.73113	0.00020	0.00003	0.00491
4,4-dimethylheptane	0.10000	0.00122	0.11691	0.00014	0.00002	0.00393
2,3,5-trimethylhexane	0.03000	0.00037	0.37895	0.00014	0.00002	0.00382
2,2,5-trimethylhexane	0.02000	0.00024	0.54293	0.00013	0.00002	0.00365
3,3-diethylpentane	0.07000	0.00086	0.11691	0.00010	0.00001	0.00275
3,3-dimethylheptane	0.07000	0.00086	0.11691	0.00010	0.00001	0.00275
2,3,4-trimethylhexane	0.02000	0.00024	0.37895	0.00009	0.00001	0.00254
c-octene-2	0.01000	0.00014	0.57018	0.00008	0.00001	0.00191
1,1-methylethylcyclopentane	0.01000	0.00014	0.52453	0.00007	0.00001	0.00176
1c,3-dimethylcyclohexane	0.01000	0.00014	0.52453	0.00007	0.00001	0.00176
2t-ethylmethylcyclopentane	0.01000	0.00014	0.52453	0.00007	0.00001	0.00176
3c-ethylmethylcyclopentane	0.01000	0.00014	0.52453	0.00007	0.00001	0.00176
3t-ethylmethylcyclopentane	0.01000	0.00014	0.52453	0.00007	0.00001	0.00176
1c,2t,4t-trimethylcyclohexane	0.03000	0.00037	0.16373	0.00006	0.00001	0.00165
3,5-dimethylheptane	0.04000	0.00049	0.11691	0.00006	0.00001	0.00157
3,4-dimethylheptane	0.03000	0.00037	0.11691	0.00004	0.00001	0.00118
Styrene	0.01000	0.00015	0.22287	0.00003	0.00004	0.00075

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
1,1,2-trimethylcyclohexane	0.01000	0.00012	0.16373	0.00002	0.000003	0.00055
1c,2t,4c-trimethylcyclohexane	0.01000	0.00012	0.16373	0.00002	0.000003	0.00055
2,2-dimethylheptane	0.01000	0.00012	0.11691	0.00001	0.000002	0.00039
4-ethylheptane	0.01000	0.00012	0.11691	0.00001	0.000002	0.00039

Sample 2, T=72.1° F

Average Molecular Weight		
Liquid Phase:	189.92	lb/lbmol
Vapor Phase:	57.07	lb/lbmol
Methane / Ethane		
Methane K:	167.10	
Methane Mass% Liq	0.00004964	%
Methane y_i	982.09	ppm
Methane Mass% Vap	0.02760403	%
Ethane K:	28.63	
Ethane p_i :	0.06	psia

Component	m _{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m _{vap} (%)
propane	0.25000	0.01077	128.84470	1.38734	0.41877	32.35932
n-butane	0.74000	0.02418	32.33790	0.78194	0.23603	24.04011
i-butane	0.25000	0.00817	46.68395	0.38136	0.11511	11.72466
i-pentane	0.81000	0.02132	12.06945	0.25735	0.07768	9.82121
n-pentane	0.98000	0.02580	8.94467	0.23075	0.06965	8.80609
n-hexane	1.03000	0.02270	2.59458	0.05890	0.01778	2.68471
2-methylpentane	0.60000	0.01322	3.65310	0.04831	0.01458	2.20194
methylcyclopentane	0.70000	0.01580	2.35878	0.03726	0.01125	1.65874
3-methylpentane	0.38000	0.00837	3.27061	0.02739	0.00827	1.24855
methylcyclohexane	1.54000	0.02979	0.78425	0.02336	0.00705	1.21329
cyclohexane	0.64000	0.01444	1.66588	0.02406	0.00726	1.07107
cyclopentane	0.18000	0.00487	5.50431	0.02683	0.00810	0.99533
ethane	0.01000	0.00063		0.06101	0.01808	0.95284
n-heptane	1.04000	0.01971	0.77018	0.01518	0.00458	0.80467
3-methylhexane	0.43000	0.00815	1.04376	0.00851	0.00257	0.45088
2-methylhexane	0.36000	0.00682	1.11769	0.00763	0.00230	0.40422
1t,2-dimethylcyclopentane	0.31000	0.00600	1.28929	0.00773	0.00233	0.40152
1t,3-dimethylcyclopentane	0.22000	0.00426	1.28929	0.00549	0.00166	0.28495
1c,3-dimethylcyclopentane	0.19000	0.00368	1.28929	0.00474	0.00143	0.24609
n-octane	0.99000	0.01646	0.23106	0.00380	0.00115	0.22981
2,3-dimethylpentane	0.15000	0.00284	1.17057	0.00333	0.00100	0.17639
2-methylheptane	0.44000	0.00732	0.34326	0.00251	0.00076	0.15173
1,1-dimethylcyclopentane	0.10000	0.00193	1.28929	0.00249	0.00075	0.12952
1c,2t,3-trimethylcyclopentane	0.42000	0.00711	0.26991	0.00192	0.00058	0.11388
2,2,3-trimethylhexane	0.57000	0.00844	0.18914	0.00160	0.00048	0.10831
toluene	0.22000	0.00453	0.47674	0.00216	0.00065	0.10536
3-methylheptane	0.26000	0.00432	0.34326	0.00148	0.00045	0.08966
2,4-dimethylpentane	0.05000	0.00095	1.68004	0.00159	0.00048	0.08439
2,2-dimethylhexane	0.14000	0.00233	0.57233	0.00133	0.00040	0.08049
1c,2c,3-trimethylcyclopentane	0.25000	0.00423	0.26991	0.00114	0.00034	0.06779
2,2-dimethylbutane	0.01000	0.00022	5.54852	0.00122	0.00037	0.05574

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
n-nonane	0.94000	0.01392	0.05669	0.00079	0.00024	0.05354
1t,4-dimethylcyclohexane	0.19000	0.00322	0.26991	0.00087	0.00026	0.05152
benzene	0.03000	0.00073	1.61828	0.00118	0.00036	0.04877
n-propylcyclopentane	0.17000	0.00288	0.26991	0.00078	0.00023	0.04610
4-methylheptane	0.13000	0.00216	0.34223	0.00074	0.00022	0.04469
2,2,3-trimethylpentane	0.05000	0.00083	0.83572	0.00069	0.00021	0.04198
1,4-dimethylbenzene	0.28000	0.00501	0.14614	0.00073	0.00022	0.04111
2,5-dimethylhexane	0.08000	0.00133	0.50948	0.00068	0.00020	0.04095
2,4-dimethylhexane	0.08000	0.00133	0.50803	0.00068	0.00020	0.04083
2,2-dimethylpentane	0.02000	0.00038	1.79972	0.00068	0.00021	0.03616
1,3-dimethylbenzene	0.24000	0.00429	0.13786	0.00059	0.00018	0.03324
1c,2t,4-trimethylcyclopentane	0.12000	0.00203	0.26991	0.00055	0.00017	0.03254
1t,2c,3-trimethylcyclopentane	0.12000	0.00203	0.26991	0.00055	0.00017	0.03254
2-methyl-3-ethylpentane	0.06000	0.00100	0.50948	0.00051	0.00015	0.03071
2,3-dimethylhexane	0.06000	0.00100	0.39143	0.00039	0.00012	0.02359
2t-ethylmethylcyclopentane	0.08000	0.00135	0.26991	0.00037	0.00011	0.02169
i-propylcyclopentane	0.08000	0.00135	0.26991	0.00037	0.00011	0.02169
2,2,3-trimethylbutane	0.01000	0.00019	1.75367	0.00033	0.00010	0.01762
1c,2-dimethylcyclohexane	0.07000	0.00118	0.24055	0.00028	0.00009	0.01692
1,1-dimethylcyclohexane	0.06000	0.00102	0.26991	0.00027	0.00008	0.01627
1,2-dimethylbenzene	0.14000	0.00250	0.10833	0.00027	0.00008	0.01524
2,3,5-trimethylhexane	0.08000	0.00118	0.18914	0.00022	0.00007	0.01520
3,3-dimethylpentane	0.01000	0.00019	1.41421	0.00027	0.00008	0.01421
ethylbenzene	0.08000	0.00143	0.15620	0.00022	0.00007	0.01255
3-methyloctane	0.21000	0.00311	0.05669	0.00018	0.00005	0.01196
1c,2-dimethylcyclopentane	0.04000	0.00077	0.26991	0.00021	0.00006	0.01085
3-ethylhexane	0.03000	0.00050	0.33317	0.00017	0.00005	0.01004
2-methyloctane	0.17000	0.00252	0.05669	0.00014	0.00004	0.00968
3,3-dimethylhexane	0.02000	0.00033	0.47758	0.00016	0.00005	0.00960
4-methyloctane	0.15000	0.00222	0.05669	0.00013	0.00004	0.00854
3c-ethylmethylcyclopentane	0.03000	0.00051	0.26991	0.00014	0.00004	0.00813
3t-ethylmethylcyclopentane	0.03000	0.00051	0.26991	0.00014	0.00004	0.00813
3-methyl-3-ethylpentane	0.02000	0.00033	0.38632	0.00013	0.00004	0.00776
3,4-dimethylhexane	0.02000	0.00033	0.36235	0.00012	0.00004	0.00728
1,1-methylethylcyclopentane	0.02000	0.00034	0.26991	0.00009	0.00003	0.00542
2,5-dimethylheptane	0.09000	0.00133	0.05669	0.00008	0.00002	0.00513
2,6-dimethylheptane	0.02000	0.00030	0.18914	0.00006	0.00002	0.00380
c-octene-2	0.01000	0.00017	0.28862	0.00005	0.00001	0.00290
3,3-dimethylheptane	0.05000	0.00074	0.05669	0.00004	0.00001	0.00285
4-ethylheptane	0.05000	0.00074	0.05669	0.00004	0.00001	0.00285
2,2,5-trimethylhexane	0.01000	0.00015	0.27648	0.00004	0.00001	0.00278
1c,3-dimethylcyclohexane	0.01000	0.00017	0.26991	0.00005	0.00001	0.00271
1,1,4-trimethylcyclohexane	0.03000	0.00045	0.07721	0.00003	0.00001	0.00233
2,4,4-trimethylhexane	0.01000	0.00015	0.22259	0.00003	0.00001	0.00224

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
2,3,4-trimethylhexane	0.01000	0.00015	0.18914	0.00003	0.00001	0.00190
2,4-dimethylheptane	0.01000	0.00015	0.18914	0.00003	0.00001	0.00190
3,3-diethylpentane	0.03000	0.00044	0.05669	0.00003	0.00001	0.00171
1,1,3-trimethylcyclohexane	0.02000	0.00030	0.07721	0.00002	0.00001	0.00155
3,4-dimethylheptane	0.02000	0.00030	0.05669	0.00002	0.00001	0.00114
2,4-dimethylheptene-1	0.01000	0.00015	0.08699	0.00001	0.000004	0.00087
nonene-1	0.01000	0.00015	0.08699	0.00001	0.000004	0.00087
1,1,2-trimethylcyclohexane	0.01000	0.00015	0.07721	0.00001	0.000004	0.00078
1c,2t,4c-trimethylcyclohexane	0.01000	0.00015	0.07721	0.00001	0.000004	0.00078
3,5-dimethylheptane	0.01000	0.00015	0.05669	0.00001	0.000003	0.00057

Sample 2, T=95° F

Average Molecular Weight		
Liquid Phase:	189.92	lb/lbmol
Vapor Phase:	58.09	lb/lbmol
Methane / Ethane		
Methane K:	190.00	
Methane Mass% Liq	0.00004964	%
Methane y_i	1116.67	ppm
Methane Mass% Vap	0.03083285	%
Ethane K:	35.50	
Ethane p_i :	0.11	psia

Component	m _{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m _{vap} (%)
propane	0.25000	0.01077	176.65380	1.90213	0.39354	29.87280
n-butane	0.74000	0.02418	47.45453	1.14747	0.23740	23.75321
i-butane	0.25000	0.00817	67.05331	0.54776	0.11333	11.33896
i-pentane	0.81000	0.02132	18.67352	0.39816	0.08238	10.23114
n-pentane	0.98000	0.02580	14.16178	0.36533	0.07559	9.38765
n-hexane	1.03000	0.02270	4.43665	0.10071	0.02084	3.09105
2-methylpentane	0.60000	0.01322	6.08944	0.08052	0.01666	2.47139
methylcyclopentane	0.70000	0.01580	4.03151	0.06368	0.01318	1.90888
methylcyclohexane	1.54000	0.02979	1.42286	0.04238	0.00877	1.48216
3-methylpentane	0.38000	0.00837	5.48122	0.04590	0.00950	1.40888
cyclohexane	0.64000	0.01444	2.90982	0.04203	0.00869	1.25968
ethane	0.01000	0.00063		0.11086	0.02242	1.16063
cyclopentane	0.18000	0.00487	8.96348	0.04369	0.00904	1.09135
n-heptane	1.04000	0.01971	1.42681	0.02813	0.00582	1.00372
3-methylhexane	0.43000	0.00815	1.88579	0.01537	0.00318	0.54850
2-methylhexane	0.36000	0.00682	2.01204	0.01373	0.00284	0.48995
1t,2-dimethylcyclopentane	0.31000	0.00600	2.27727	0.01366	0.00283	0.47752
1t,3-dimethylcyclopentane	0.22000	0.00426	2.27727	0.00969	0.00200	0.33888
n-octane	0.99000	0.01646	0.46549	0.00766	0.00159	0.31172
1c,3-dimethylcyclopentane	0.19000	0.00368	2.27727	0.00837	0.00173	0.29267
2,3-dimethylpentane	0.15000	0.00284	2.08700	0.00593	0.00123	0.21175
2-methylheptane	0.44000	0.00732	0.66923	0.00490	0.00101	0.19918
1,1-dimethylcyclopentane	0.10000	0.00193	2.27727	0.00440	0.00091	0.15404
1c,2t,3-trimethylcyclopentane	0.42000	0.00711	0.52453	0.00373	0.00077	0.14902
2,2,3-trimethylhexane	0.57000	0.00844	0.37895	0.00320	0.00066	0.14611
toluene	0.22000	0.00453	0.90368	0.00410	0.00085	0.13448
3-methylheptane	0.26000	0.00432	0.66923	0.00289	0.00060	0.11770
2,2-dimethylhexane	0.14000	0.00233	1.06869	0.00249	0.00051	0.10120
2,4-dimethylpentane	0.05000	0.00095	2.93417	0.00278	0.00058	0.09924
1c,2c,3-trimethylcyclopentane	0.25000	0.00423	0.52453	0.00222	0.00046	0.08870
n-nonane	0.94000	0.01392	0.11691	0.00163	0.00034	0.07434

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
1t,4-dimethylcyclohexane	0.19000	0.00322	0.52453	0.00169	0.00035	0.06741
2,2-dimethylbutane	0.01000	0.00022	8.93253	0.00197	0.00041	0.06042
n-propylcyclopentane	0.17000	0.00288	0.52453	0.00151	0.00031	0.06032
4-methylheptane	0.13000	0.00216	0.66709	0.00144	0.00030	0.05866
benzene	0.03000	0.00073	2.86487	0.00209	0.00043	0.05814
1,4-dimethylbenzene	0.28000	0.00501	0.29779	0.00149	0.00031	0.05640
2,5-dimethylhexane	0.08000	0.00133	0.96528	0.00128	0.00027	0.05223
2,4-dimethylhexane	0.08000	0.00133	0.96101	0.00128	0.00026	0.05200
2,2,3-trimethylpentane	0.05000	0.00083	1.51201	0.00126	0.00026	0.05114
1,3-dimethylbenzene	0.24000	0.00429	0.28049	0.00120	0.00025	0.04553
1c,2t,4-trimethylcyclopentane	0.12000	0.00203	0.52453	0.00107	0.00022	0.04258
1t,2c,3-trimethylcyclopentane	0.12000	0.00203	0.52453	0.00107	0.00022	0.04258
2,2-dimethylpentane	0.02000	0.00038	3.11782	0.00118	0.00024	0.04218
2-methyl-3-ethylpentane	0.06000	0.00100	0.96528	0.00096	0.00020	0.03918
2,3-dimethylhexane	0.06000	0.00100	0.75123	0.00075	0.00016	0.03049
2t-ethylmethylcyclopentane	0.08000	0.00135	0.52453	0.00071	0.00015	0.02838
i-propylcyclopentane	0.08000	0.00135	0.52453	0.00071	0.00015	0.02838
1c,2-dimethylcyclohexane	0.07000	0.00118	0.47036	0.00056	0.00012	0.02227
1,2-dimethylbenzene	0.14000	0.00250	0.22572	0.00057	0.00012	0.02137
1,1-dimethylcyclohexane	0.06000	0.00102	0.52453	0.00053	0.00011	0.02129
2,3,5-trimethylhexane	0.08000	0.00118	0.37895	0.00045	0.00009	0.02051
2,2,3-trimethylbutane	0.01000	0.00019	3.01654	0.00057	0.00012	0.02040
ethylbenzene	0.08000	0.00143	0.31926	0.00046	0.00009	0.01728
3,3-dimethylpentane	0.01000	0.00019	2.47165	0.00047	0.00010	0.01672
3-methyloctane	0.21000	0.00311	0.11691	0.00036	0.00008	0.01661
1c,2-dimethylcyclopentane	0.04000	0.00077	0.52453	0.00041	0.00008	0.01419
2-methyloctane	0.17000	0.00252	0.11691	0.00029	0.00006	0.01344
3-ethylhexane	0.03000	0.00050	0.65042	0.00032	0.00007	0.01320
3,3-dimethylhexane	0.02000	0.00033	0.90338	0.00030	0.00006	0.01222
4-methyloctane	0.15000	0.00222	0.11691	0.00026	0.00005	0.01186
3c-ethylmethylcyclopentane	0.03000	0.00051	0.52453	0.00027	0.00006	0.01064
3t-ethylmethylcyclopentane	0.03000	0.00051	0.52453	0.00027	0.00006	0.01064
3-methyl-3-ethylpentane	0.02000	0.00033	0.73113	0.00024	0.00005	0.00989
3,4-dimethylhexane	0.02000	0.00033	0.69690	0.00023	0.00005	0.00943
2,5-dimethylheptane	0.09000	0.00133	0.11691	0.00016	0.00003	0.00712
1,1-methylethylcyclopentane	0.02000	0.00034	0.52453	0.00018	0.00004	0.00710
2,6-dimethylheptane	0.02000	0.00030	0.37895	0.00011	0.00002	0.00513
3,3-dimethylheptane	0.05000	0.00074	0.11691	0.00009	0.00002	0.00395
4-ethylheptane	0.05000	0.00074	0.11691	0.00009	0.00002	0.00395
c-octene-2	0.01000	0.00017	0.57018	0.00010	0.00002	0.00386
2,2,5-trimethylhexane	0.01000	0.00015	0.54293	0.00008	0.00002	0.00367
1c,3-dimethylcyclohexane	0.01000	0.00017	0.52453	0.00009	0.00002	0.00355
1,1,4-trimethylcyclohexane	0.03000	0.00045	0.16373	0.00007	0.00002	0.00332
2,4,4-trimethylhexane	0.01000	0.00015	0.43934	0.00007	0.00001	0.00297

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
2,3,4-trimethylhexane	0.01000	0.00015	0.37895	0.00006	0.00001	0.00256
2,4-dimethylheptane	0.01000	0.00015	0.37895	0.00006	0.00001	0.00256
3,3-diethylpentane	0.03000	0.00044	0.11691	0.00005	0.00001	0.00237
1,1,3-trimethylcyclohexane	0.02000	0.00030	0.16373	0.00005	0.00001	0.00221
3,4-dimethylheptane	0.02000	0.00030	0.11691	0.00003	0.00001	0.00158
2,4-dimethylheptene-1	0.01000	0.00015	0.18738	0.00003	0.00001	0.00127
nonene-1	0.01000	0.00015	0.18738	0.00003	0.00001	0.00127
1,1,2-trimethylcyclohexane	0.01000	0.00015	0.16373	0.00002	0.00001	0.00111
1c,2t,4c-trimethylcyclohexane	0.01000	0.00015	0.16373	0.00002	0.00001	0.00111
3,5-dimethylheptane	0.01000	0.00015	0.11691	0.00002	0.000004	0.00079

Sample 3, T=72.1° F

Average Molecular Weight		
Liquid Phase:	160.51	lb/lbmol
Vapor Phase:	56.89	lb/lbmol
Methane / Ethane		
Methane K:	167.10	
Methane Mass% Liq	0.00000000	%
Methane y_i	0.00	ppm
Methane Mass% Vap	0.00000000	%
Ethane K:	28.63	
Ethane p_i :	0.21	psia

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
propane	0.39000	0.01420	128.84470	1.82911	0.41802	32.40233
n-butane	1.31000	0.03618	32.33790	1.16989	0.26737	27.31670
n-pentane	1.96000	0.04360	8.94467	0.39003	0.08914	11.30487
i-pentane	1.32000	0.02937	12.06945	0.35443	0.08100	10.27321
i-butane	0.28000	0.00773	46.68395	0.36098	0.08250	8.42890
n-hexane	1.84000	0.03427	2.59458	0.08892	0.02032	3.07844
2-methylpentane	1.04000	0.01937	3.65310	0.07076	0.01617	2.44985
ethane	0.03000	0.00160		0.21026	0.04585	2.42341
methylcyclopentane	1.05000	0.02003	2.35878	0.04724	0.01080	1.59706
3-methylpentane	0.75000	0.01397	3.27061	0.04569	0.01044	1.58174
cyclohexane	1.20000	0.02289	1.66588	0.03813	0.00871	1.28905
methylcyclohexane	2.13000	0.03482	0.78425	0.02731	0.00624	1.07715
cyclopentane	0.29000	0.00664	5.50431	0.03653	0.00835	1.02931
n-heptane	1.65000	0.02643	0.77018	0.02036	0.00465	0.81944
3-methylhexane	0.68000	0.01089	1.04376	0.01137	0.00260	0.45767
1t,2-dimethylcyclopentane	0.53000	0.00866	1.28929	0.01117	0.00255	0.44063
2-methylhexane	0.54000	0.00865	1.11769	0.00967	0.00221	0.38919
1t,3-dimethylcyclopentane	0.36000	0.00589	1.28929	0.00759	0.00173	0.29929
benzene	0.28000	0.00575	1.61828	0.00931	0.00213	0.29218
1c,3-dimethylcyclopentane	0.32000	0.00523	1.28929	0.00674	0.00154	0.26604
toluene	0.73000	0.01272	0.47674	0.00606	0.00139	0.22441
n-octane	1.33000	0.01869	0.23106	0.00432	0.00099	0.19817
2,3-dimethylpentane	0.20000	0.00320	1.17057	0.00375	0.00086	0.15096
2,2-dimethylbutane	0.04000	0.00075	5.54852	0.00413	0.00094	0.14311
2-methylheptane	0.64000	0.00899	0.34326	0.00309	0.00071	0.14166
1,1-dimethylcyclopentane	0.16000	0.00262	1.28929	0.00337	0.00077	0.13302
1c,2t,3-trimethylcyclopentane	0.58000	0.00830	0.26991	0.00224	0.00051	0.10095
2,2,3-trimethylhexane	0.71000	0.00889	0.18914	0.00168	0.00038	0.08659
3-methylheptane	0.36000	0.00506	0.34326	0.00174	0.00040	0.07968
2,2-dimethylhexane	0.21000	0.00295	0.57233	0.00169	0.00039	0.07750
1c,2c,3-trimethylcyclopentane	0.29000	0.00415	0.26991	0.00112	0.00026	0.05047

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
4-methylheptane	0.21000	0.00295	0.34223	0.00101	0.00023	0.04634
n-propylcyclopentane	0.26000	0.00372	0.26991	0.00100	0.00023	0.04525
2,2,3-trimethylpentane	0.08000	0.00112	0.83572	0.00094	0.00021	0.04311
1t,2c,3-trimethylcyclopentane	0.24000	0.00343	0.26991	0.00093	0.00021	0.04177
2,5-dimethylhexane	0.12000	0.00169	0.50948	0.00086	0.00020	0.03942
1t,4-dimethylcyclohexane	0.22000	0.00315	0.26991	0.00085	0.00019	0.03829
n-nonane	0.97000	0.01214	0.05669	0.00069	0.00016	0.03546
2,2-dimethylpentane	0.03000	0.00048	1.79972	0.00086	0.00020	0.03482
1c,2t,4-trimethylcyclopentane	0.20000	0.00286	0.26991	0.00077	0.00018	0.03481
1,3-dimethylbenzene	0.39000	0.00590	0.13786	0.00081	0.00019	0.03467
2-methyl-3-ethylpentane	0.10000	0.00141	0.50948	0.00072	0.00016	0.03285
2,4-dimethylhexane	0.10000	0.00141	0.50803	0.00071	0.00016	0.03276
1,4-dimethylbenzene	0.26000	0.00393	0.14614	0.00057	0.00013	0.02450
2t-ethylmethylcyclopentane	0.13000	0.00186	0.26991	0.00050	0.00011	0.02263
2,4-dimethylpentane	0.02000	0.00032	1.68004	0.00054	0.00012	0.02167
ethylbenzene	0.19000	0.00287	0.15620	0.00045	0.00010	0.01914
3,3-dimethylpentane	0.02000	0.00032	1.41421	0.00045	0.00010	0.01824
2,3-dimethylhexane	0.07000	0.00098	0.39143	0.00039	0.00009	0.01767
i-propylcyclopentane	0.09000	0.00129	0.26991	0.00035	0.00008	0.01566
3-ethylhexane	0.07000	0.00098	0.33317	0.00033	0.00007	0.01504
1,1-dimethylcyclohexane	0.08000	0.00114	0.26991	0.00031	0.00007	0.01392
1,2-dimethylbenzene	0.18000	0.00272	0.10833	0.00029	0.00007	0.01257
2,3,5-trimethylhexane	0.10000	0.00125	0.18914	0.00024	0.00005	0.01220
2,2,3-trimethylbutane	0.01000	0.00016	1.75367	0.00028	0.00006	0.01131
1c,2-dimethylcyclopentane	0.06000	0.00098	0.26991	0.00026	0.00006	0.01044
3c-ethylmethylcyclopentane	0.06000	0.00086	0.26991	0.00023	0.00005	0.01044
3-methyloctane	0.28000	0.00350	0.05669	0.00020	0.00005	0.01024
3,4-dimethylhexane	0.04000	0.00056	0.36235	0.00020	0.00005	0.00935
3,3-dimethylhexane	0.03000	0.00042	0.47758	0.00020	0.00005	0.00924
3t-ethylmethylcyclopentane	0.05000	0.00072	0.26991	0.00019	0.00004	0.00870
1c,2-dimethylcyclohexane	0.05000	0.00072	0.24055	0.00017	0.00004	0.00776
2-methyloctane	0.21000	0.00263	0.05669	0.00015	0.00003	0.00768
3-methyl-3-ethylpentane	0.03000	0.00042	0.38632	0.00016	0.00004	0.00747
4-methyloctane	0.17000	0.00213	0.05669	0.00012	0.00003	0.00621
2,4,4-trimethylhexane	0.03000	0.00038	0.22259	0.00008	0.00002	0.00431
2,5-dimethylheptane	0.11000	0.00138	0.05669	0.00008	0.00002	0.00402
1,1-methylethylcyclopentane	0.02000	0.00029	0.26991	0.00008	0.00002	0.00348
1,1,4-trimethylcyclohexane	0.06000	0.00076	0.07721	0.00006	0.00001	0.00299
2,3,4-trimethylhexane	0.02000	0.00025	0.18914	0.00005	0.00001	0.00244
2,4-dimethylheptane	0.02000	0.00025	0.18914	0.00005	0.00001	0.00244
2,6-dimethylheptane	0.02000	0.00025	0.18914	0.00005	0.00001	0.00244
3,3-dimethylheptane	0.06000	0.00075	0.05669	0.00004	0.00001	0.00219
1,1,3-trimethylcyclohexane	0.04000	0.00051	0.07721	0.00004	0.00001	0.00199
3,3-diethylpentane	0.05000	0.00063	0.05669	0.00004	0.00001	0.00183

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
4-ethylheptane	0.05000	0.00063	0.05669	0.00004	0.00001	0.00183
1c,3-dimethylcyclohexane	0.01000	0.00014	0.26991	0.00004	0.00001	0.00174
nonene-1	0.02000	0.00025	0.08699	0.00002	0.00001	0.00112
1c,2t,4c-trimethylcyclohexane	0.02000	0.00025	0.07721	0.00002	0.000004	0.00100
3,4-dimethylheptane	0.02000	0.00025	0.05669	0.00001	0.000003	0.00073
1,1,2-trimethylcyclohexane	0.01000	0.00013	0.07721	0.00001	0.000002	0.00050
3,5-dimethylheptane	0.01000	0.00013	0.05669	0.00001	0.000002	0.00037

Sample 3, T=95° F

Average Molecular Weight		
Liquid Phase:	160.51	lb/lbmol
Vapor Phase:	57.75	lb/lbmol
Methane / Ethane		
Methane K:	190.00	
Methane Mass% Liq	0.00000000	%
Methane y_i	0.00	ppm
Methane Mass% Vap	0.00000000	%
Ethane K:	35.50	
Ethane p_i :	0.38	psia

Component	m_{liq} (%)	χ_i	p_i^o (psia)	p_i (psia)	y_i	m_{vap} (%)
propane	0.39000	0.01420	176.65380	2.50781	0.39423	30.10500
n-butane	1.31000	0.03618	47.45453	1.71676	0.26988	27.16440
n-pentane	1.96000	0.04360	14.16178	0.61752	0.09707	12.12900
i-pentane	1.32000	0.02937	18.67352	0.54837	0.08620	10.77088
i-butane	0.28000	0.00773	67.05331	0.51849	0.08151	8.20407
n-hexane	1.84000	0.03427	4.43665	0.15205	0.02390	3.56717
ethane	0.03000	0.00160		0.38344	0.05685	2.96035
2-methylpentane	1.04000	0.01937	6.08944	0.11796	0.01854	2.76733
methylcyclopentane	1.05000	0.02003	4.03151	0.08073	0.01269	1.84973
3-methylpentane	0.75000	0.01397	5.48122	0.07657	0.01204	1.79635
cyclohexane	1.20000	0.02289	2.90982	0.06660	0.01047	1.52580
methylcyclohexane	2.13000	0.03482	1.42286	0.04954	0.00779	1.32432
cyclopentane	0.29000	0.00664	8.96348	0.05949	0.00935	1.13586
n-heptane	1.65000	0.02643	1.42681	0.03771	0.00593	1.02873
3-methylhexane	0.68000	0.01089	1.88579	0.02054	0.00323	0.56034
1t,2-dimethylcyclopentane	0.53000	0.00866	2.27727	0.01973	0.00310	0.52740
2-methylhexane	0.54000	0.00865	2.01204	0.01740	0.00274	0.47477
1t,3-dimethylcyclopentane	0.36000	0.00589	2.27727	0.01340	0.00211	0.35824
benzene	0.28000	0.00575	2.86487	0.01648	0.00259	0.35052
1c,3-dimethylcyclopentane	0.32000	0.00523	2.27727	0.01191	0.00187	0.31843
toluene	0.73000	0.01272	0.90368	0.01149	0.00181	0.28826
n-octane	1.33000	0.01869	0.46549	0.00870	0.00137	0.27053
2-methylheptane	0.64000	0.00899	0.66923	0.00602	0.00095	0.18716
2,3-dimethylpentane	0.20000	0.00320	2.08700	0.00669	0.00105	0.18239
1,1-dimethylcyclopentane	0.16000	0.00262	2.27727	0.00596	0.00094	0.15922
2,2-dimethylbutane	0.04000	0.00075	8.93253	0.00666	0.00105	0.15613
1c,2t,3-trimethylcyclopentane	0.58000	0.00830	0.52453	0.00435	0.00068	0.13294
2,2,3-trimethylhexane	0.71000	0.00889	0.37895	0.00337	0.00053	0.11757
3-methylheptane	0.36000	0.00506	0.66923	0.00339	0.00053	0.10528
2,2-dimethylhexane	0.21000	0.00295	1.06869	0.00315	0.00050	0.09807
1c,2c,3-trimethylcyclopentane	0.29000	0.00415	0.52453	0.00218	0.00034	0.06647

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
4-methylheptane	0.21000	0.00295	0.66709	0.00197	0.00031	0.06121
n-propylcyclopentane	0.26000	0.00372	0.52453	0.00195	0.00031	0.05959
1t,2c,3-trimethylcyclopentane	0.24000	0.00343	0.52453	0.00180	0.00028	0.05501
2,2,3-trimethylpentane	0.08000	0.00112	1.51201	0.00170	0.00027	0.05286
2,5-dimethylhexane	0.12000	0.00169	0.96528	0.00163	0.00026	0.05062
1t,4-dimethylcyclohexane	0.22000	0.00315	0.52453	0.00165	0.00026	0.05042
n-nonane	0.97000	0.01214	0.11691	0.00142	0.00022	0.04955
1,3-dimethylbenzene	0.39000	0.00590	0.28049	0.00165	0.00026	0.04780
1c,2t,4-trimethylcyclopentane	0.20000	0.00286	0.52453	0.00150	0.00024	0.04584
2-methyl-3-ethylpentane	0.10000	0.00141	0.96528	0.00136	0.00021	0.04218
2,4-dimethylhexane	0.10000	0.00141	0.96101	0.00135	0.00021	0.04199
2,2-dimethylpentane	0.03000	0.00048	3.11782	0.00150	0.00024	0.04087
1,4-dimethylbenzene	0.26000	0.00393	0.29779	0.00117	0.00018	0.03383
2t-ethylmethylcyclopentane	0.13000	0.00186	0.52453	0.00098	0.00015	0.02980
ethylbenzene	0.19000	0.00287	0.31926	0.00092	0.00014	0.02651
2,4-dimethylpentane	0.02000	0.00032	2.93417	0.00094	0.00015	0.02564
2,3-dimethylhexane	0.07000	0.00098	0.75123	0.00074	0.00012	0.02298
3,3-dimethylpentane	0.02000	0.00032	2.47165	0.00079	0.00012	0.02160
i-propylcyclopentane	0.09000	0.00129	0.52453	0.00068	0.00011	0.02063
3-ethylhexane	0.07000	0.00098	0.65042	0.00064	0.00010	0.01989
1,1-dimethylcyclohexane	0.08000	0.00114	0.52453	0.00060	0.00009	0.01834
1,2-dimethylbenzene	0.18000	0.00272	0.22572	0.00061	0.00010	0.01775
2,3,5-trimethylhexane	0.10000	0.00125	0.37895	0.00047	0.00007	0.01656
3-methyloctane	0.28000	0.00350	0.11691	0.00041	0.00006	0.01430
1c,2-dimethylcyclopentane	0.06000	0.00098	0.52453	0.00051	0.00008	0.01375
3c-ethylmethylcyclopentane	0.06000	0.00086	0.52453	0.00045	0.00007	0.01375
2,2,3-trimethylbutane	0.01000	0.00016	3.01654	0.00048	0.00008	0.01318
3,4-dimethylhexane	0.04000	0.00056	0.69690	0.00039	0.00006	0.01218
3,3-dimethylhexane	0.03000	0.00042	0.90338	0.00038	0.00006	0.01184
3t-ethylmethylcyclopentane	0.05000	0.00072	0.52453	0.00038	0.00006	0.01146
2-methyloctane	0.21000	0.00263	0.11691	0.00031	0.00005	0.01073
1c,2-dimethylcyclohexane	0.05000	0.00072	0.47036	0.00034	0.00005	0.01028
3-methyl-3-ethylpentane	0.03000	0.00042	0.73113	0.00031	0.00005	0.00958
4-methyloctane	0.17000	0.00213	0.11691	0.00025	0.00004	0.00868
2,4,4-trimethylhexane	0.03000	0.00038	0.43934	0.00016	0.00003	0.00576
2,5-dimethylheptane	0.11000	0.00138	0.11691	0.00016	0.00003	0.00562
1,1-methylethylcyclopentane	0.02000	0.00029	0.52453	0.00015	0.00002	0.00458
1,1,4-trimethylcyclohexane	0.06000	0.00076	0.16373	0.00012	0.00002	0.00429
2,3,4-trimethylhexane	0.02000	0.00025	0.37895	0.00009	0.00001	0.00331
2,4-dimethylheptane	0.02000	0.00025	0.37895	0.00009	0.00001	0.00331
2,6-dimethylheptane	0.02000	0.00025	0.37895	0.00009	0.00001	0.00331
3,3-dimethylheptane	0.06000	0.00075	0.11691	0.00009	0.00001	0.00307
1,1,3-trimethylcyclohexane	0.04000	0.00051	0.16373	0.00008	0.00001	0.00286
3,3-diethylpentane	0.05000	0.00063	0.11691	0.00007	0.00001	0.00255

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
4-ethylheptane	0.05000	0.00063	0.11691	0.00007	0.00001	0.00255
1c,3-dimethylcyclohexane	0.01000	0.00014	0.52453	0.00008	0.00001	0.00229
nonene-1	0.02000	0.00025	0.18738	0.00005	0.00001	0.00164
1c,2t,4c-trimethylcyclohexane	0.02000	0.00025	0.16373	0.00004	0.00001	0.00143
3,4-dimethylheptane	0.02000	0.00025	0.11691	0.00003	0.00005	0.00102
1,1,2-trimethylcyclohexane	0.01000	0.00013	0.16373	0.00002	0.00003	0.00072
3,5-dimethylheptane	0.01000	0.00013	0.11691	0.00001	0.00002	0.00051

Sample 4, T=72.1° F

Average Molecular Weight		
Liquid Phase:	156.73	lb/lbmol
Vapor Phase:	53.04	lb/lbmol
Methane / Ethane		
Methane K:	167.10	
Methane Mass% Liq	0.00000000	%
Methane y_i	0.00	ppm
Methane Mass% Vap	0.00000000	%
Ethane K:	28.63	
Ethane p_i :	0.58	psia

Component	m _{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m _{vap} (%)
propane	0.70000	0.02488	128.84470	3.20556	0.54688	45.46606
n-butane	1.85000	0.04988	32.33790	1.61316	0.27521	30.15826
n-pentane	2.20000	0.04779	8.94467	0.42746	0.07293	9.91995
i-butane	0.36000	0.00971	46.68395	0.45317	0.07731	8.47213
i-pentane	1.11000	0.02411	12.06945	0.29102	0.04965	6.75356
ethane	0.06000	0.00313		0.57642	0.08953	5.07587
n-hexane	2.0000	0.03637	2.59458	0.09437	0.01610	2.61589
2-methylpentane	1.06000	0.01928	3.65310	0.07042	0.01201	1.95205
methylcyclopentane	1.0000	0.01862	2.35878	0.04393	0.00749	1.18908
3-methylpentane	0.72000	0.01309	3.27061	0.04283	0.00731	1.18709
n-heptane	1.82000	0.02847	0.77018	0.02192	0.00374	0.70662
cyclopentane	0.25000	0.00559	5.50431	0.03075	0.00525	0.69369
methylcyclohexane	1.33000	0.02123	0.78425	0.01665	0.00284	0.52581
cyclohexane	0.55000	0.01024	1.66588	0.01706	0.00291	0.46188
1t,2-dimethylcyclopentane	0.70000	0.01117	1.28929	0.01441	0.00246	0.45496
3-methylhexane	0.81000	0.01267	1.04376	0.01322	0.00226	0.42619
2-methylhexane	0.58000	0.00907	1.11769	0.01014	0.00173	0.32679
1t,3-dimethylcyclopentane	0.44000	0.00702	1.28929	0.00905	0.00154	0.28597
1c,3-dimethylcyclopentane	0.38000	0.00607	1.28929	0.00782	0.00133	0.24698
benzene	0.20000	0.00401	1.61828	0.00649	0.00111	0.16316
n-octane	1.29000	0.01770	0.23106	0.00409	0.00070	0.15026
2,3-dimethylpentane	0.23000	0.00360	1.17057	0.00421	0.00072	0.13572
2-methylheptane	0.73000	0.01002	0.34326	0.00344	0.00059	0.12632
1,1-dimethylcyclopentane	0.16000	0.00255	1.28929	0.00329	0.00056	0.10399
toluene	0.40000	0.00680	0.47674	0.00324	0.00055	0.09613
3-methylheptane	0.46000	0.00631	0.34326	0.00217	0.00037	0.07960
1c,2t,3-trimethylcyclopentane	0.58000	0.00810	0.26991	0.00219	0.00037	0.07892
2,2-dimethylhexane	0.27000	0.00370	0.57233	0.00212	0.00036	0.07790
2,2,3-trimethylhexane	0.64000	0.00782	0.18914	0.00148	0.00025	0.06102
2,2-dimethylbutane	0.02000	0.00036	5.54852	0.00202	0.00034	0.05594
4-methylheptane	0.27000	0.00370	0.34223	0.00127	0.00022	0.04658

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
1t,2c,3-trimethylcyclopentane	0.33000	0.00461	0.26991	0.00124	0.00021	0.04490
1c,2t,4-trimethylcyclopentane	0.32000	0.00447	0.26991	0.00121	0.00021	0.04354
1c,2c,3-trimethylcyclopentane	0.28000	0.00391	0.26991	0.00106	0.00018	0.03810
n-propylcyclopentane	0.27000	0.00377	0.26991	0.00102	0.00017	0.03674
2-methyl-3-ethylpentane	0.12000	0.00165	0.50948	0.00084	0.00014	0.03082
2,5-dimethylhexane	0.12000	0.00165	0.50948	0.00084	0.00014	0.03082
2,4-dimethylhexane	0.12000	0.00165	0.50803	0.00084	0.00014	0.03073
n-nonane	1.04000	0.01271	0.05669	0.00072	0.00012	0.02972
2,2,3-trimethylpentane	0.07000	0.00096	0.83572	0.00080	0.00014	0.02949
1t,4-dimethylcyclohexane	0.21000	0.00293	0.26991	0.00079	0.00014	0.02857
1,3-dimethylbenzene	0.37000	0.00546	0.13786	0.00075	0.00013	0.02571
i-propylcyclopentane	0.17000	0.00237	0.26991	0.00064	0.00011	0.02313
2t-ethylmethylcyclopentane	0.16000	0.00223	0.26991	0.00060	0.00010	0.02177
2,3-dimethylhexane	0.11000	0.00151	0.39143	0.00059	0.00010	0.02171
1,4-dimethylbenzene	0.27000	0.00399	0.14614	0.00058	0.00010	0.01989
2,2-dimethylpentane	0.02000	0.00031	1.79972	0.00056	0.00010	0.01814
2,4-dimethylpentane	0.02000	0.00031	1.68004	0.00053	0.00009	0.01694
3-ethylhexane	0.09000	0.00123	0.33317	0.00041	0.00007	0.01512
3,3-dimethylpentane	0.02000	0.00031	1.41421	0.00044	0.00008	0.01426
3-methyloctane	0.39000	0.00477	0.05669	0.00027	0.00005	0.01115
3,4-dimethylhexane	0.06000	0.00082	0.36235	0.00030	0.00005	0.01096
1c,2-dimethylcyclopentane	0.08000	0.00128	0.26991	0.00034	0.00006	0.01089
2,3,5-trimethylhexane	0.11000	0.00134	0.18914	0.00025	0.00004	0.01049
1,2-dimethylbenzene	0.18000	0.00266	0.10833	0.00029	0.00005	0.00983
3-methyl-3-ethylpentane	0.05000	0.00069	0.38632	0.00027	0.00005	0.00974
1c,2-dimethylcyclohexane	0.08000	0.00112	0.24055	0.00027	0.00005	0.00970
1,1-dimethylcyclohexane	0.07000	0.00098	0.26991	0.00026	0.00005	0.00952
3c-ethylmethylcyclopentane	0.07000	0.00098	0.26991	0.00026	0.00005	0.00952
3t-ethylmethylcyclopentane	0.06000	0.00084	0.26991	0.00023	0.00004	0.00816
ethylbenzene	0.10000	0.00148	0.15620	0.00023	0.00004	0.00787
2-methyloctane	0.26000	0.00318	0.05669	0.00018	0.00003	0.00743
3,3-dimethylhexane	0.03000	0.00041	0.47758	0.00020	0.00003	0.00722
4-methyloctane	0.24000	0.00293	0.05669	0.00017	0.00003	0.00686
2,4,4-trimethylhexane	0.05000	0.00061	0.22259	0.00014	0.00002	0.00561
3,3-dimethylheptene-1	0.12000	0.00149	0.08699	0.00013	0.00002	0.00526
2,6-dimethylheptane	0.04000	0.00049	0.18914	0.00009	0.00002	0.00381
2,5-dimethylheptane	0.12000	0.00147	0.05669	0.00008	0.00001	0.00343
2,4-dimethylheptane	0.03000	0.00037	0.18914	0.00007	0.00001	0.00286
1,1-methylethylcyclopentane	0.02000	0.00028	0.26991	0.00008	0.00001	0.00272
1c,3-dimethylcyclohexane	0.02000	0.00028	0.26991	0.00008	0.00001	0.00272
1,1,4-trimethylcyclohexane	0.06000	0.00074	0.07721	0.00006	0.00001	0.00234
3,3-diethylpentane	0.08000	0.00098	0.05669	0.00006	0.00001	0.00229
3,3-dimethylheptane	0.07000	0.00086	0.05669	0.00005	0.00001	0.00200
1,1,3-trimethylcyclohexane	0.05000	0.00062	0.07721	0.00005	0.00001	0.00195

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
2,3,4-trimethylhexane	0.02000	0.00024	0.18914	0.00005	0.00001	0.00191
4-ethylheptane	0.05000	0.00061	0.05669	0.00003	0.00001	0.00143
1c,2t,4c-trimethylcyclohexane	0.03000	0.00037	0.07721	0.00003	0.000005	0.00117
3,4-dimethylheptane	0.04000	0.00049	0.05669	0.00003	0.000005	0.00114
2,4-dimethylheptene-1	0.02000	0.00025	0.08699	0.00002	0.000004	0.00088
nonene-1	0.02000	0.00025	0.08699	0.00002	0.000004	0.00088
1,1,2-trimethylcyclohexane	0.01000	0.00012	0.07721	0.00001	0.000002	0.00039
1c,2t,3c-trimethylcyclohexane	0.01000	0.00012	0.07721	0.00001	0.000002	0.00039
3,5-dimethylheptane	0.01000	0.00012	0.05669	0.00001	0.000001	0.00029

Sample 4, T=95° F

Average Molecular Weight		
Liquid Phase:	156.73	lb/lbmol
Vapor Phase:	53.57	lb/lbmol
Methane / Ethane		
Methane K:	190.00	
Methane Mass% Liq	0.00000000	%
Methane y_i	0.00	ppm
Methane Mass% Vap	0.00000000	%
Ethane K:	35.50	
Ethane p_i :	1.03	psia

Component	m_{liq} (%)	χ_i	p_i^o (psia)	p_i (psia)	y_i	m_{vap} (%)
propane	0.70000	0.02488	176.65380	4.39501	0.53058	43.67220
n-butane	1.85000	0.04988	47.45453	2.36724	0.28578	31.00513
n-pentane	2.20000	0.04779	14.16178	0.67678	0.08170	11.00335
i-butane	0.36000	0.00971	67.05331	0.65090	0.07858	8.52525
i-pentane	1.11000	0.02411	18.67352	0.45025	0.05436	7.32038
ethane	0.06000	0.00313		1.03445	0.11102	6.23121
n-hexane	2.0000	0.03637	4.43665	0.16138	0.01948	3.13379
2-methylpentane	1.06000	0.01928	6.08944	0.11739	0.01417	2.27965
methylcyclopentane	1.0000	0.01862	4.03151	0.07508	0.00906	1.42381
3-methylpentane	0.72000	0.01309	5.48122	0.07177	0.00866	1.39378
n-heptane	1.82000	0.02847	1.42681	0.04062	0.00490	0.91711
cyclopentane	0.25000	0.00559	8.96348	0.05008	0.00605	0.79141
methylcyclohexane	1.33000	0.02123	1.42286	0.03021	0.00365	0.66834
cyclohexane	0.55000	0.01024	2.90982	0.02980	0.00360	0.56521
1t,2-dimethylcyclopentane	0.70000	0.01117	2.27727	0.02544	0.00307	0.56299
3-methylhexane	0.81000	0.01267	1.88579	0.02389	0.00288	0.53946
2-methylhexane	0.58000	0.00907	2.01204	0.01825	0.00220	0.41214
1t,3-dimethylcyclopentane	0.44000	0.00702	2.27727	0.01599	0.00193	0.35388
1c,3-dimethylcyclopentane	0.38000	0.00607	2.27727	0.01381	0.00167	0.30562
n-octane	1.29000	0.01770	0.46549	0.00824	0.00099	0.21207
benzene	0.20000	0.00401	2.86487	0.01150	0.00139	0.20236
2-methylheptane	0.73000	0.01002	0.66923	0.00670	0.00081	0.17254
2,3-dimethylpentane	0.23000	0.00360	2.08700	0.00751	0.00091	0.16953
1,1-dimethylcyclopentane	0.16000	0.00255	2.27727	0.00582	0.00070	0.12868
toluene	0.40000	0.00680	0.90368	0.00615	0.00074	0.12766
3-methylheptane	0.46000	0.00631	0.66923	0.00422	0.00051	0.10872
1c,2t,3-trimethylcyclopentane	0.58000	0.00810	0.52453	0.00425	0.00051	0.10744
2,2-dimethylhexane	0.27000	0.00370	1.06869	0.00396	0.00048	0.10191
2,2,3-trimethylhexane	0.64000	0.00782	0.37895	0.00296	0.00036	0.08565
4-methylheptane	0.27000	0.00370	0.66709	0.00247	0.00030	0.06361
2,2-dimethylbutane	0.02000	0.00036	8.93253	0.00325	0.00039	0.06309

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
1t,2c,3-trimethylcyclopentane	0.33000	0.00461	0.52453	0.00242	0.00029	0.06113
1c,2t,4-trimethylcyclopentane	0.32000	0.00447	0.52453	0.00234	0.00028	0.05928
1c,2c,3-trimethylcyclopentane	0.28000	0.00391	0.52453	0.00205	0.00025	0.05187
n-propylcyclopentane	0.27000	0.00377	0.52453	0.00198	0.00024	0.05002
n-nonane	1.04000	0.01271	0.11691	0.00149	0.00018	0.04294
2-methyl-3-ethylpentane	0.12000	0.00165	0.96528	0.00159	0.00019	0.04091
2,5-dimethylhexane	0.12000	0.00165	0.96528	0.00159	0.00019	0.04091
2,4-dimethylhexane	0.12000	0.00165	0.96101	0.00158	0.00019	0.04073
1t,4-dimethylcyclohexane	0.21000	0.00293	0.52453	0.00154	0.00019	0.03890
2,2,3-trimethylpentane	0.07000	0.00096	1.51201	0.00145	0.00018	0.03738
1,3-dimethylbenzene	0.37000	0.00546	0.28049	0.00153	0.00018	0.03665
i-propylcyclopentane	0.17000	0.00237	0.52453	0.00125	0.00015	0.03149
2t-ethylmethylcyclopentane	0.16000	0.00223	0.52453	0.00117	0.00014	0.02964
2,3-dimethylhexane	0.11000	0.00151	0.75123	0.00113	0.00014	0.02918
1,4-dimethylbenzene	0.27000	0.00399	0.29779	0.00119	0.00014	0.02840
2,2-dimethylpentane	0.02000	0.00031	3.11782	0.00098	0.00012	0.02202
2,4-dimethylpentane	0.02000	0.00031	2.93417	0.00092	0.00011	0.02073
3-ethylhexane	0.09000	0.00123	0.65042	0.00080	0.00010	0.02067
3,3-dimethylpentane	0.02000	0.00031	2.47165	0.00077	0.00009	0.01746
3-methyloctane	0.39000	0.00477	0.11691	0.00056	0.00007	0.01610
1c,2-dimethylcyclopentane	0.08000	0.00128	0.52453	0.00067	0.00008	0.01482
3,4-dimethylhexane	0.06000	0.00082	0.69690	0.00057	0.00007	0.01477
2,3,5-trimethylhexane	0.11000	0.00134	0.37895	0.00051	0.00006	0.01472
1,2-dimethylbenzene	0.18000	0.00266	0.22572	0.00060	0.00007	0.01435
1c,2-dimethylcyclohexane	0.08000	0.00112	0.47036	0.00053	0.00006	0.01329
1,1-dimethylcyclohexane	0.07000	0.00098	0.52453	0.00051	0.00006	0.01297
3c-ethylmethylcyclopentane	0.07000	0.00098	0.52453	0.00051	0.00006	0.01297
3-methyl-3-ethylpentane	0.05000	0.00069	0.73113	0.00050	0.00006	0.01291
ethylbenzene	0.10000	0.00148	0.31926	0.00047	0.00006	0.01128
3t-ethylmethylcyclopentane	0.06000	0.00084	0.52453	0.00044	0.00005	0.01111
2-methyloctane	0.26000	0.00318	0.11691	0.00037	0.00004	0.01074
4-methyloctane	0.24000	0.00293	0.11691	0.00034	0.00004	0.00991
3,3-dimethylhexane	0.03000	0.00041	0.90338	0.00037	0.00004	0.00957
3,3-dimethylheptene-1	0.12000	0.00149	0.18738	0.00028	0.00003	0.00794
2,4,4-trimethylhexane	0.05000	0.00061	0.43934	0.00027	0.00003	0.00776
2,6-dimethylheptane	0.04000	0.00049	0.37895	0.00019	0.00002	0.00535
2,5-dimethylheptane	0.12000	0.00147	0.11691	0.00017	0.00002	0.00495
2,4-dimethylheptane	0.03000	0.00037	0.37895	0.00014	0.00002	0.00402
1,1-methylethylcyclopentane	0.02000	0.00028	0.52453	0.00015	0.00002	0.00370
1c,3-dimethylcyclohexane	0.02000	0.00028	0.52453	0.00015	0.00002	0.00370
1,1,4-trimethylcyclohexane	0.06000	0.00074	0.16373	0.00012	0.00001	0.00347
3,3-diethylpentane	0.08000	0.00098	0.11691	0.00011	0.00001	0.00330
1,1,3-trimethylcyclohexane	0.05000	0.00062	0.16373	0.00010	0.00001	0.00289
3,3-dimethylheptane	0.07000	0.00086	0.11691	0.00010	0.00001	0.00289

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
2,3,4-trimethylhexane	0.02000	0.00024	0.37895	0.00009	0.00001	0.00268
4-ethylheptane	0.05000	0.00061	0.11691	0.00007	0.00001	0.00206
1c,2t,4c-trimethylcyclohexane	0.03000	0.00037	0.16373	0.00006	0.00001	0.00173
3,4-dimethylheptane	0.04000	0.00049	0.11691	0.00006	0.00001	0.00165
2,4-dimethylheptene-1	0.02000	0.00025	0.18738	0.00005	0.00001	0.00132
nonene-1	0.02000	0.00025	0.18738	0.00005	0.00001	0.00132
1,1,2-trimethylcyclohexane	0.01000	0.00012	0.16373	0.00002	0.000002	0.00058
1c,2t,3c-trimethylcyclohexane	0.01000	0.00012	0.16373	0.00002	0.000002	0.00058
3,5-dimethylheptane	0.01000	0.00012	0.11691	0.00001	0.000002	0.00041

Sample 5, T=72.1° F

Average Molecular Weight		
Liquid Phase:	152.85	lb/lbmol
Vapor Phase:	55.94	lb/lbmol
Methane / Ethane		
Methane K:	167.10	
Methane Mass% Liq	0.00000000	%
Methane y_i	0.00	ppm
Methane Mass% Vap	0.00000000	%
Ethane K:	28.63	
Ethane p_i :	0.26	psia

Component	m _{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m _{vap} (%)
propane	0.44000	0.01525	128.84470	1.96514	0.45897	36.17973
n-butane	1.30000	0.03419	32.33790	1.10556	0.25821	26.82880
n-pentane	1.82000	0.03856	8.94467	0.34489	0.08055	10.38919
i-butane	0.30000	0.00789	46.68395	0.36831	0.08602	8.93789
i-pentane	1.13000	0.02394	12.06945	0.28894	0.06748	8.70386
ethane	0.04000	0.00203		0.26466	0.05821	3.12922
n-hexane	1.85000	0.03281	2.59458	0.08514	0.01988	3.06327
2-methylpentane	1.02000	0.01809	3.65310	0.06609	0.01544	2.37798
cyclohexane	1.62000	0.02942	1.66588	0.04901	0.01145	1.72229
methylcyclohexane	2.94000	0.04577	0.78425	0.03589	0.00838	1.47145
methylcyclopentane	0.94000	0.01707	2.35878	0.04027	0.00941	1.41501
3-methylpentane	0.63000	0.01117	3.27061	0.03655	0.00854	1.31497
n-heptane	1.90000	0.02898	0.77018	0.02232	0.00521	0.93388
cyclopentane	0.17000	0.00371	5.50431	0.02039	0.00476	0.59717
3-methylhexane	0.71000	0.01083	1.04376	0.01130	0.00264	0.47294
1t,2-dimethylcyclopentane	0.52000	0.00810	1.28929	0.01044	0.00244	0.42786
2-methylhexane	0.57000	0.00869	1.11769	0.00972	0.00227	0.40658
2,3-dimethylbutane	0.11000	0.00195	4.06734	0.00794	0.00185	0.28553
benzene	0.27000	0.00528	1.61828	0.00855	0.00200	0.27885
1c,3-dimethylcyclopentane	0.33000	0.00514	1.28929	0.00662	0.00155	0.27152
1t,3-dimethylcyclopentane	0.31000	0.00483	1.28929	0.00622	0.00145	0.25507
toluene	0.83000	0.01377	0.47674	0.00656	0.00153	0.25252
n-octane	1.53000	0.02047	0.23106	0.00473	0.00110	0.22562
1,1-dimethylcyclopentane	0.23000	0.00358	1.28929	0.00462	0.00108	0.18924
2-methylheptane	0.81000	0.01084	0.34326	0.00372	0.00087	0.17744
1c,2t,3-trimethylcyclopentane	0.88000	0.01199	0.26991	0.00324	0.00076	0.15158
2,3-dimethylpentane	0.18000	0.00275	1.17057	0.00321	0.00075	0.13447
2,2-dimethylbutane	0.03000	0.00053	5.54852	0.00295	0.00069	0.10623
2,2-dimethylhexane	0.27000	0.00361	0.57233	0.00207	0.00048	0.09862
3-methylheptane	0.41000	0.00549	0.34326	0.00188	0.00044	0.08982
2,4-dimethylpentane	0.07000	0.00107	1.68004	0.00179	0.00042	0.07505

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
n-propylcyclopentane	0.35000	0.00477	0.26991	0.00129	0.00030	0.06029
1t,2-dimethylcyclohexane	0.37000	0.00504	0.24055	0.00121	0.00028	0.05680
1t,4-dimethylcyclohexane	0.32000	0.00436	0.26991	0.00118	0.00027	0.05512
1,3-dimethylbenzene	0.61000	0.00878	0.13786	0.00121	0.00028	0.05367
4-methylheptane	0.23000	0.00308	0.34223	0.00105	0.00025	0.05023
n-nonane	1.31000	0.01561	0.05669	0.00089	0.00021	0.04740
ethylcyclopentane	0.11000	0.00171	0.67389	0.00115	0.00027	0.04731
2,3-dimethylhexane	0.18000	0.00241	0.39143	0.00094	0.00022	0.04496
i-propylcyclopentane	0.25000	0.00341	0.26991	0.00092	0.00021	0.04306
1c,2t,4-trimethylcyclopentane	0.24000	0.00327	0.26991	0.00088	0.00021	0.04134
1t,2c,3-trimethylcyclopentane	0.22000	0.00300	0.26991	0.00081	0.00019	0.03790
3-ethylpentane	0.06000	0.00092	0.98304	0.00090	0.00021	0.03764
2,2,3-trimethylhexane	0.29000	0.00346	0.18914	0.00065	0.00015	0.03500
1,1,4-trimethylcyclohexane	0.70000	0.00848	0.07721	0.00065	0.00015	0.03449
2,2-dimethylpentane	0.03000	0.00046	1.79972	0.00082	0.00019	0.03446
2,4-dimethylhexane	0.10000	0.00134	0.50803	0.00068	0.00016	0.03242
1,4-dimethylbenzene	0.33000	0.00475	0.14614	0.00069	0.00016	0.03078
2,5-dimethylhexane	0.08000	0.00107	0.50948	0.00055	0.00013	0.02601
1,1-dimethylcyclohexane	0.13000	0.00177	0.26991	0.00048	0.00011	0.02239
3,3-dimethylpentane	0.02000	0.00031	1.41421	0.00043	0.00010	0.01805
2t-ethylmethylcyclopentane	0.10000	0.00136	0.26991	0.00037	0.00009	0.01723
1,2-dimethylbenzene	0.22000	0.00317	0.10833	0.00034	0.00008	0.01521
ethylbenzene	0.15000	0.00216	0.15620	0.00034	0.00008	0.01495
3-ethylhexane	0.07000	0.00094	0.33317	0.00031	0.00007	0.01488
1c,2-dimethylcyclopentane	0.08000	0.00125	0.26991	0.00034	0.00008	0.01378
3-methyloctane	0.35000	0.00417	0.05669	0.00024	0.00006	0.01266
3,3-dimethylhexane	0.04000	0.00054	0.47758	0.00026	0.00006	0.01219
2,2,3-trimethylbutane	0.01000	0.00015	1.75367	0.00027	0.00006	0.01119
2-methyl-3-ethylpentane	0.03000	0.00040	0.50948	0.00020	0.00005	0.00975
3,4-dimethylhexane	0.04000	0.00054	0.36235	0.00019	0.00005	0.00925
2-methyloctane	0.25000	0.00298	0.05669	0.00017	0.00004	0.00904
3c-ethylmethylcyclopentane	0.05000	0.00068	0.26991	0.00018	0.00004	0.00861
3t-ethylmethylcyclopentane	0.05000	0.00068	0.26991	0.00018	0.00004	0.00861
4-methyloctane	0.21000	0.00250	0.05669	0.00014	0.00003	0.00760
3-methyl-3-ethylpentane	0.03000	0.00040	0.38632	0.00016	0.00004	0.00740
1,1-methylethylcyclopentane	0.03000	0.00041	0.26991	0.00011	0.00003	0.00517
2,6-dimethylheptane	0.04000	0.00048	0.18914	0.00009	0.00002	0.00483
2,5-dimethylheptane	0.13000	0.00155	0.05669	0.00009	0.00002	0.00470
1c,2-dimethylcyclohexane	0.03000	0.00041	0.24055	0.00010	0.00002	0.00461
2,4,4-trimethylhexane	0.03000	0.00036	0.22259	0.00008	0.00002	0.00426
*1c,3c,5-trimethylcyclohexane	0.07000	0.00085	0.07721	0.00007	0.00002	0.00345
1c,3-dimethylcyclohexane	0.02000	0.00027	0.26991	0.00007	0.00002	0.00345
4-ethylheptane	0.08000	0.00095	0.05669	0.00005	0.00001	0.00289
2,3,4-trimethylpentane	0.01000	0.00013	0.44990	0.00006	0.00001	0.00287

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
2,2,3,4-tetramethylpentane	0.02000	0.00024	0.20988	0.00005	0.00001	0.00268
2,3,4-trimethylhexane	0.02000	0.00024	0.18914	0.00005	0.00001	0.00241
2,4-dimethylheptane	0.02000	0.00024	0.18914	0.00005	0.00001	0.00241
3,3-diethylpentane	0.06000	0.00072	0.05669	0.00004	0.00001	0.00217
c-octene-2	0.01000	0.00014	0.28862	0.00004	0.00001	0.00184
2,4-dimethylheptene-1	0.03000	0.00036	0.08699	0.00003	0.00001	0.00167
1c,2t,4c-trimethylcyclohexane	0.03000	0.00036	0.07721	0.00003	0.00001	0.00148
2,3,5-trimethylhexane	0.01000	0.00012	0.18914	0.00002	0.00001	0.00121
3,5-dimethylheptane	0.03000	0.00036	0.05669	0.00002	0.000005	0.00109
1,1,3-trimethylcyclohexane	0.02000	0.00024	0.07721	0.00002	0.000004	0.00099
i-butylcyclopentane	0.02000	0.00024	0.07721	0.00002	0.000004	0.00099
3,3-dimethylheptane	0.02000	0.00024	0.05669	0.00001	0.000003	0.00072
3,4-dimethylheptane	0.02000	0.00024	0.05669	0.00001	0.000003	0.00072
1c,2t,3c-trimethylcyclohexane	0.01000	0.00012	0.07721	0.00001	0.000002	0.00049
2,2-dimethylheptane	0.01000	0.00012	0.05669	0.00001	0.000002	0.00036

Sample 5, T=95° F

Average Molecular Weight		
Liquid Phase:	152.85	lb/lbmol
Vapor Phase:	56.79	lb/lbmol
Methane / Ethane		
Methane K:	190.00	
Methane Mass% Liq	0.00000000	%
Methane y_i	0.00	ppm
Methane Mass% Vap	0.00000000	%
Ethane K:	35.50	
Ethane p_i :	0.48	psia

Component	m _{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m _{vap} (%)
propane	0.44000	0.01525	176.65380	2.69433	0.43569	33.83301
n-butane	1.30000	0.03419	47.45453	1.62237	0.26235	26.85258
n-pentane	1.82000	0.03856	14.16178	0.54605	0.08830	11.21901
i-pentane	1.13000	0.02394	18.67352	0.44704	0.07229	9.18480
i-butane	0.30000	0.00789	67.05331	0.52902	0.08555	8.75602
ethane	0.04000	0.00203		0.48112	0.07218	3.82230
n-hexane	1.85000	0.03281	4.43665	0.14558	0.02354	3.57266
2-methylpentane	1.02000	0.01809	6.08944	0.11017	0.01782	2.70360
cyclohexane	1.62000	0.02942	2.90982	0.08561	0.01384	2.05185
methylcyclohexane	2.94000	0.04577	1.42286	0.06512	0.01053	1.82085
methylcyclopentane	0.94000	0.01707	4.03151	0.06883	0.01113	1.64953
3-methylpentane	0.63000	0.01117	5.48122	0.06125	0.00990	1.50308
n-heptane	1.90000	0.02898	1.42681	0.04135	0.00669	1.18000
cyclopentane	0.17000	0.00371	8.96348	0.03321	0.00537	0.66327
3-methylhexane	0.71000	0.01083	1.88579	0.02042	0.00330	0.58280
1t,2-dimethylcyclopentane	0.52000	0.00810	2.27727	0.01843	0.00298	0.51545
2-methylhexane	0.57000	0.00869	2.01204	0.01749	0.00283	0.49920
benzene	0.27000	0.00528	2.86487	0.01514	0.00245	0.33669
1c,3-dimethylcyclopentane	0.33000	0.00514	2.27727	0.01170	0.00189	0.32711
toluene	0.83000	0.01377	0.90368	0.01244	0.00201	0.32648
2,3-dimethylbutane	0.11000	0.00195	6.69218	0.01306	0.00211	0.32042
n-octane	1.53000	0.02047	0.46549	0.00953	0.00154	0.31000
1t,3-dimethylcyclopentane	0.31000	0.00483	2.27727	0.01099	0.00178	0.30729
2-methylheptane	0.81000	0.01084	0.66923	0.00725	0.00117	0.23595
1,1-dimethylcyclopentane	0.23000	0.00358	2.27727	0.00815	0.00132	0.22799
1c,2t,3-trimethylcyclopentane	0.88000	0.01199	0.52453	0.00629	0.00102	0.20092
2,3-dimethylpentane	0.18000	0.00275	2.08700	0.00573	0.00093	0.16352
2,2-dimethylhexane	0.27000	0.00361	1.06869	0.00386	0.00062	0.12560
3-methylheptane	0.41000	0.00549	0.66923	0.00367	0.00059	0.11943
2,2-dimethylbutane	0.03000	0.00053	8.93253	0.00475	0.00077	0.11664
2,4-dimethylpentane	0.07000	0.00107	2.93417	0.00313	0.00051	0.08940

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
n-propylcyclopentane	0.35000	0.00477	0.52453	0.00250	0.00040	0.07991
1t,2-dimethylcyclohexane	0.37000	0.00504	0.47036	0.00237	0.00038	0.07575
1,3-dimethylbenzene	0.61000	0.00878	0.28049	0.00246	0.00040	0.07448
1t,4-dimethylcyclohexane	0.32000	0.00436	0.52453	0.00229	0.00037	0.07306
4-methylheptane	0.23000	0.00308	0.66709	0.00205	0.00033	0.06678
n-nonane	1.31000	0.01561	0.11691	0.00183	0.00030	0.06666
ethylcyclopentane	0.11000	0.00171	1.24259	0.00213	0.00034	0.05950
2,3-dimethylhexane	0.18000	0.00241	0.75123	0.00181	0.00029	0.05886
i-propylcyclopentane	0.25000	0.00341	0.52453	0.00179	0.00029	0.05708
1c,2t,4-trimethylcyclopentane	0.24000	0.00327	0.52453	0.00171	0.00028	0.05480
1t,2c,3-trimethylcyclopentane	0.22000	0.00300	0.52453	0.00157	0.00025	0.05023
1,1,4-trimethylcyclohexane	0.70000	0.00848	0.16373	0.00139	0.00022	0.04989
2,2,3-trimethylhexane	0.29000	0.00346	0.37895	0.00131	0.00021	0.04784
3-ethylpentane	0.06000	0.00092	1.78043	0.00163	0.00026	0.04650
1,4-dimethylbenzene	0.33000	0.00475	0.29779	0.00141	0.00023	0.04277
2,4-dimethylhexane	0.10000	0.00134	0.96101	0.00129	0.00021	0.04183
2,2-dimethylpentane	0.03000	0.00046	3.11782	0.00143	0.00023	0.04071
2,5-dimethylhexane	0.08000	0.00107	0.96528	0.00103	0.00017	0.03361
1,1-dimethylcyclohexane	0.13000	0.00177	0.52453	0.00093	0.00015	0.02968
2t-ethylmethylcyclopentane	0.10000	0.00136	0.52453	0.00071	0.00012	0.02283
1,2-dimethylbenzene	0.22000	0.00317	0.22572	0.00071	0.00012	0.02161
3,3-dimethylpentane	0.02000	0.00031	2.47165	0.00075	0.00012	0.02152
ethylbenzene	0.15000	0.00216	0.31926	0.00069	0.00011	0.02084
3-ethylhexane	0.07000	0.00094	0.65042	0.00061	0.00010	0.01982
1c,2-dimethylcyclopentane	0.08000	0.00125	0.52453	0.00065	0.00011	0.01827
3-methyloctane	0.35000	0.00417	0.11691	0.00049	0.00008	0.01781
3,3-dimethylhexane	0.04000	0.00054	0.90338	0.00048	0.00008	0.01573
2,2,3-trimethylbutane	0.01000	0.00015	3.01654	0.00046	0.00007	0.01313
2-methyloctane	0.25000	0.00298	0.11691	0.00035	0.00006	0.01272
2-methyl-3-ethylpentane	0.03000	0.00040	0.96528	0.00039	0.00006	0.01260
3,4-dimethylhexane	0.04000	0.00054	0.69690	0.00037	0.00006	0.01213
3c-ethylmethylcyclopentane	0.05000	0.00068	0.52453	0.00036	0.00006	0.01142
3t-ethylmethylcyclopentane	0.05000	0.00068	0.52453	0.00036	0.00006	0.01142
4-methyloctane	0.21000	0.00250	0.11691	0.00029	0.00005	0.01069
3-methyl-3-ethylpentane	0.03000	0.00040	0.73113	0.00029	0.00005	0.00955
1,1-methylethylcyclopentane	0.03000	0.00041	0.52453	0.00021	0.00003	0.00685
2,5-dimethylheptane	0.13000	0.00155	0.11691	0.00018	0.00003	0.00662
2,6-dimethylheptane	0.04000	0.00048	0.37895	0.00018	0.00003	0.00660
1c,2-dimethylcyclohexane	0.03000	0.00041	0.47036	0.00019	0.00003	0.00614
2,4,4-trimethylhexane	0.03000	0.00036	0.43934	0.00016	0.00003	0.00574
*1c,3c,5-trimethylcyclohexane	0.07000	0.00085	0.16373	0.00014	0.00002	0.00499
1c,3-dimethylcyclohexane	0.02000	0.00027	0.52453	0.00014	0.00002	0.00457
4-ethylheptane	0.08000	0.00095	0.11691	0.00011	0.00002	0.00407
2,3,4-trimethylpentane	0.01000	0.00013	0.84444	0.00011	0.00002	0.00368

Component	m_{liq} (%)	χ_i	p_i° (psia)	p_i (psia)	y_i	m_{vap} (%)
2,2,3,4-tetramethylpentane	0.02000	0.00024	0.41398	0.00010	0.00002	0.00360
2,3,4-trimethylhexane	0.02000	0.00024	0.37895	0.00009	0.00001	0.00330
2,4-dimethylheptane	0.02000	0.00024	0.37895	0.00009	0.00001	0.00330
3,3-diethylpentane	0.06000	0.00072	0.11691	0.00008	0.00001	0.00305
c-octene-2	0.01000	0.00014	0.57018	0.00008	0.00001	0.00248
2,4-dimethylheptene-1	0.03000	0.00036	0.18738	0.00007	0.00001	0.00245
1c,2t,4c-trimethylcyclohexane	0.03000	0.00036	0.16373	0.00006	0.00001	0.00214
2,3,5-trimethylhexane	0.01000	0.00012	0.37895	0.00005	0.00001	0.00165
3,5-dimethylheptane	0.03000	0.00036	0.11691	0.00004	0.00001	0.00153
1,1,3-trimethylcyclohexane	0.02000	0.00024	0.16373	0.00004	0.00001	0.00143
i-butylcyclopentane	0.02000	0.00024	0.16373	0.00004	0.00001	0.00143
3,3-dimethylheptane	0.02000	0.00024	0.11691	0.00003	0.000005	0.00102
3,4-dimethylheptane	0.02000	0.00024	0.11691	0.00003	0.000005	0.00102
1c,2t,3c-trimethylcyclohexane	0.01000	0.00012	0.16373	0.00002	0.000003	0.00071
2,2-dimethylheptane	0.01000	0.00012	0.11691	0.00001	0.000002	0.00051

Appendix A-4— Antoine Coefficients and Molecular Weights

$$\log_{10}(P/\text{bar}) = A - \frac{B}{T/\text{K} + C} \quad (9)$$

Compound	Formula	Mol. Wt.	VPsurrogate	A	B	C
*1c,3c,5-trimethylcyclohexane	C ₉ H ₁₈	126.242	i-propylcyclohexane	—	—	—
1-nonene	—	—	—	4.079	1,435.359	-67.615
1-octene	—	—	—	4.058	1,353.486	-60.386
1,1-dimethylcyclohexane	C ₈ H ₁₆	112.215	i-propylcyclopentane	—	—	—
1,1-dimethylcyclopentane	C ₇ H ₁₄	98.188	—	3.955	1,226.557	-50.393
1,1-methylethylcyclopentane	C ₈ H ₁₆	112.215	i-propylcyclopentane	—	—	—
1,1,2-trimethylcyclohexane	C ₉ H ₁₈	126.242	i-propylcyclohexane	—	—	—
1,1,3-trimethylcyclohexane	C ₉ H ₁₈	126.242	i-propylcyclohexane	—	—	—
1,1,4-trimethylcyclohexane	C ₉ H ₁₈	126.242	i-propylcyclohexane	—	—	—
1,2-dimethylbenzene	C ₈ H ₁₀	106.167	—	4.938	1,901.373	-26.268
1,3-dimethylbenzene	C ₈ H ₁₀	106.167	—	5.092	1,996.545	-14.772
1,4-dimethylbenzene	C ₈ H ₁₀	106.167	—	4.146	1,474.403	-55.377
1c,2-dimethylcyclohexane	C ₈ H ₁₆	112.215	i-propylcyclopentane	3.967	1,369.525	-57.110
1c,2-dimethylcyclopentane	C ₇ H ₁₄	98.188	i-propylcyclopentane	—	—	—
1c,2c,3-trimethylcyclopentane	C ₈ H ₁₆	112.215	i-propylcyclopentane	—	—	—
1c,2t,3-trimethylcyclopentane	C ₈ H ₁₆	112.215	i-propylcyclopentane	—	—	—
1c,2t,3c-trimethylcyclohexane	C ₉ H ₁₈	126.242	i-propylcyclohexane	—	—	—
1c,2t,4-trimethylcyclopentane	C ₈ H ₁₆	112.215	i-propylcyclopentane	—	—	—
1c,2t,4c-trimethylcyclohexane	C ₉ H ₁₈	126.242	i-propylcyclohexane	—	—	—
1c,2t,4t-trimethylcyclohexane	C ₉ H ₁₈	126.242	i-propylcyclohexane	—	—	—
1c,3-dimethylcyclohexane	C ₈ H ₁₆	112.215	i-propylcyclopentane	—	—	—
1c,3-dimethylcyclopentane	C ₇ H ₁₄	98.188	1,1-dimethylcyclopentane	—	—	—
1c,3c,5c-trimethylcyclohexane	C ₉ H ₁₈	126.242	—	—	—	—
1t,2-dimethylcyclohexane	C ₈ H ₁₆	112.215	1c,2-dimethylcyclohexane	—	—	—
1t,2-dimethylcyclopentane	C ₇ H ₁₄	98.188	1,1-dimethylcyclopentane	—	—	—
1t,2c,3-trimethylcyclopentane	C ₈ H ₁₆	112.215	i-propylcyclopentane	—	—	—
1t,3-dimethylcyclopentane	C ₇ H ₁₄	98.188	1,1-dimethylcyclopentane	—	—	—
1t,4-dimethylcyclohexane	C ₈ H ₁₆	112.215	i-propylcyclopentane	—	—	—
2-methyl-3-ethylpentane	C ₈ H ₁₈	114.231	2,5-dimethylhexane	—	—	—
2-methylheptane	C ₈ H ₁₈	114.231	—	4.042	1,337.468	-59.457
2-methylhexane	C ₇ H ₁₆	100.204	—	4.007	1,240.869	-53.047
2-methyloctane	C ₉ H ₂₀	128.258	n-nonane	—	—	—
2-methylpentane	C ₆ H ₁₄	86.177	—	3.964	1,135.410	-46.578
2,2-dimethylbutane	C ₆ H ₁₄	86.177	—	3.880	1,081.176	-43.807
2,2-dimethylheptane	C ₉ H ₂₀	128.258	n-nonane	—	—	—
2,2-dimethylhexane	C ₈ H ₁₈	114.231	—	4.133	1,367.457	-48.436
2,2-dimethylpentane	C ₇ H ₁₆	100.204	—	3.940	1,190.298	-49.807
2,2-dimethylpropane	C ₅ H ₁₂	72.150	—	3.864	950.318	-36.329
2,2,3-trimethylbutane	C ₇ H ₁₆	100.204	—	3.922	1,203.362	-46.776

Compound	Formula	Mol. Wt.	VPsurrogate	A	B	C
2,2,3-trimethylhexane	C ₉ H ₂₀	128.258	—	4.414	1,592.354	-42.627
2,2,3-trimethylpentane	C ₈ H ₁₈	114.231	2,2,4-trimethylpentane	—	—	—
2,2,3,4-tetramethylpentane	C ₉ H ₂₀	128.258	—	3.960	1,376.496	-58.063
2,2,4-trimethylpentane	—	—	—	3.937	1,257.840	-52.415
2,2,5-trimethylhexane	C ₉ H ₂₀	128.258	—	4.252	1,471.761	-48.948
2,3-dimethylbutane	C ₆ H ₁₄	86.177	—	3.935	1,127.187	-44.200
2,3-dimethylhexane	C ₈ H ₁₈	114.231	—	4.059	1,351.645	-55.257
2,3-dimethylpentane	C ₇ H ₁₆	100.204	—	3.987	1,242.609	-50.806
2,3,4-trimethylhexane	C ₉ H ₂₀	128.258	2,2,3-trimethylhexane	—	—	—
2,3,4-trimethylpentane	C ₈ H ₁₈	114.231	—	4.156	1,420.710	-44.618
2,3,5-trimethylhexane	C ₉ H ₂₀	128.258	2,2,3-trimethylhexane	—	—	—
2,4-dimethylheptane	C ₉ H ₂₀	128.258	2,2,3-trimethylhexane	—	—	—
2,4-dimethylheptene-1	C ₉ H ₁₈	126.242	1-nonene	—	—	—
2,4-dimethylhexane	C ₈ H ₁₈	114.231	—	3.989	1,292.707	-57.970
2,4-dimethylpentane	C ₇ H ₁₆	100.204	—	3.961	1,197.608	-50.877
2,4,4-trimethylhexane	C ₉ H ₂₀	128.258	—	3.991	1,378.043	-58.046
2,5-dimethylheptane	C ₉ H ₂₀	128.258	n-nonane	—	—	—
2,5-dimethylhexane	C ₈ H ₁₈	114.231	—	3.980	1,284.664	-59.032
2,6-dimethylheptane	C ₉ H ₂₀	128.258	2,2,3-trimethylhexane	—	—	—
2t-ethylmethylcyclopentane	C ₈ H ₁₆	112.215	i-propylcyclopentane	—	—	—
3-ethylheptane	C ₉ H ₂₀	128.258	—	—	—	—
3-ethylhexane	C ₈ H ₁₈	114.231	—	4.040	1,339.865	-59.479
3-ethylpentane	C ₇ H ₁₆	100.204	—	4.005	1,254.119	-53.004
3-methyl-3-ethylpentane	C ₈ H ₁₈	114.231	—	4.048	1,380.130	-49.963
3-methylheptane	C ₈ H ₁₈	114.231	2-methylheptane	—	—	—
3-methylhexane	C ₇ H ₁₆	100.204	—	3.999	1,243.759	-53.524
3-methyloctane	C ₉ H ₂₀	128.258	n-nonane	—	—	—
3-methylpentane	C ₆ H ₁₄	86.177	—	3.974	1,152.368	-46.021
3,3-diethylpentane	C ₉ H ₂₀	128.258	n-nonane	—	—	—
3,3-dimethylheptane	C ₉ H ₂₀	128.258	n-nonane	—	—	—
3,3-dimethylheptene-1	C ₉ H ₁₈	126.242	1-nonene	—	—	—
3,3-dimethylhexane	C ₈ H ₁₈	114.231	—	3.859	1,243.387	-62.655
3,3-dimethylpentane	C ₇ H ₁₆	100.204	—	3.956	1,230.986	-47.568
3,4-dimethylheptane	C ₉ H ₂₀	128.258	n-nonane	—	—	—
3,4-dimethylhexane	C ₈ H ₁₈	114.231	—	4.098	1,382.877	-52.831
3,5-dimethylheptane	C ₉ H ₂₀	128.258	n-nonane	—	—	—
3c-ethylmethylcyclopentane	C ₈ H ₁₆	112.215	i-propylcyclopentane	—	—	—
3t-ethylmethylcyclopentane	C ₈ H ₁₆	112.215	i-propylcyclopentane	—	—	—
4-ethylheptane	C ₉ H ₂₀	128.258	n-nonane	—	—	—
4-methylheptane	C ₈ H ₁₈	114.231	—	4.060	1,347.236	-58.539
4-methyloctane	C ₉ H ₂₀	128.258	n-nonane	—	—	—
4,4-dimethylheptane	C ₉ H ₂₀	128.258	n-nonane	—	—	—
benzene	C ₆ H ₆	78.114	—	4.018	1,203.835	-53.226
c-nonene-3	C ₉ H ₁₈	126.242	1-nonene	—	—	—

Compound	Formula	Mol. Wt.	VPsurrogate	A	B	C
c-octene-2	C ₈ H ₁₆	112.215	1-octene	—	—	—
cyclohexane	C ₆ H ₁₂	84.161	—	3.970	1, 203.526	-50.287
cyclopentane	C ₅ H ₁₀	70.134	—	4.003	1, 119.208	-42.412
ethane	C ₂ H ₆	30.070	—	—	—	—
ethylbenzene	C ₈ H ₁₀	106.167	—	4.075	1, 419.315	-60.539
ethylcyclopentane	C ₇ H ₁₄	98.188	—	4.023	1, 305.001	-51.755
i-butane	C ₄ H ₁₀	58.123	—	4.328	1, 132.108	0.918
i-butylcyclopentane	C ₉ H ₁₈	126.242	i-propylcyclohexane	—	—	—
i-pentane	C ₅ H ₁₂	72.150	—	3.915	1, 020.012	-40.053
i-propylcyclohexane	—	—	—	3.997	1, 452.816	-63.759
i-propylcyclopentane	C ₈ H ₁₆	112.215	—	4.017	1, 383.340	-54.742
methylcyclohexane	C ₇ H ₁₄	98.188	1,1-dimethylcyclopentane	3.952	1, 272.865	-51.520
methylcyclopentane	C ₆ H ₁₂	84.161	—	3.988	1, 186.059	-47.108
n-butane	C ₄ H ₁₀	58.123	—	4.356	1, 175.581	-2.071
n-heptane	C ₇ H ₁₆	100.204	—	4.028	1, 268.636	-56.199
n-hexane	C ₆ H ₁₄	86.177	—	4.003	1, 171.530	-48.784
n-nonane	C ₉ H ₂₀	128.258	—	3.825	1, 492.928	-55.895
n-octane	C ₈ H ₁₈	114.231	—	4.049	1, 355.126	-63.633
n-pentane	C ₅ H ₁₂	72.150	—	3.989	1, 070.617	-40.454
n-propylcyclopentane	C ₈ H ₁₆	112.215	i-propylcyclopentane	—	—	—
nonene-1	C ₉ H ₁₈	126.242	—	4.079	1, 435.359	-67.615
propane	C ₃ H ₈	44.097	—	4.537	1, 149.360	24.906
Styrene	C ₈ H ₈	104.152	—	4.059	1, 459.909	-59.551
t-7-methyloctene-3	C ₉ H ₁₈	126.242	1-nonene	—	—	—
toluene	C ₇ H ₈	92.141	—	4.142	1, 377.578	-50.507